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SUGGESTIONS

REGARDING

FOREST ADMINISTRATION

IN THE

NORTH-WESTERN PROVINCES AND OUDH.

CHAPTER I.

INTRODUCTION.

THE present Report relates to the Oudh, Central, and School Forest Circles of the North-Western Provinces and Oudh.

I left Calcutta on the 28th January 1881. Captain E. S. Wood, the Conservator of the Oudh Circle, met me in the Rámgarh block of the Nawábganj Forest, which I inspected on the 31st. I marched thence, *viâ* Gonda, to Ikauna in Bahraich, and examined the forests near that place which form part of the Kapurthala estates in Oudh. A brief account of these forests, with suggestions regarding their management, will be found among the papers* appended to the present Report. The Bhinga Forest was examined from the 5th to the 8th February, the Charda Forest on the 9th, the Chakia Forest on the 10th, and the Motipur Forest on the 11th and 12th of that month. This closed the inspection of the forests in the Bahraich District, and on the 12th I crossed the Kauriála River and entered the Kheri District. On the 13th February the inspection of the Trans-Sárda Forests of the Kheri District was commenced, which occupied me until the 20th, and on the 21st I crossed the Sárda River to Bhira. The time from the 22nd to the 25th February was devoted to the Bhira Forests of the Kheri District, and to the Púranpur and Pilibhít Forests in the Pilibhít District.

In Oudh I had the privilege of meeting Colonel J. Perkins, the Commissioner of the Fyzabad Division, Mr. H. S. Boys, the Deputy Commissioner of Gonda, and Mr. M. L. Ferrar, the Deputy Commissioner of Bahraich; Colonel I. F. MacAndrew, the Commissioner of the Sitapur Division, and Mr. H. W. Gibson, the Deputy Commissioner of Kheri; as well as the Collector of the Pilibhít District, Mr. P. Whalley, whose forests are included within the Oudh Circle.

After seeing some of the forests in the Tarái District, under Mr. J. C. Macdonald, I joined Mr. G. Greig, the Conservator of the Central Circle, at the edge of the Horái Forest, in Kumaun, on the 5th March, and in company with him examined the Nindhaur Forests and some of the forest tracts outside the East Kumaun Hills, until the 10th March, when we reached Haldwáni. On the 12th I went to Rámnagar in order to see Sir Henry Ramsay, the

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* Appendix No. III.

Commissioner of Kumaun; and the time from the 13th to the 18th March was spent in the West Kumaun Forests. On the 18th March I entered the Pátli Dún Forest of the Garhwál Division, and examined part of this as well as of the Kohtri Dún Forest until the 27th March, when we reached Saneh, at the foot of the hills. The time from the 28th March to the 1st April was spent in the forests of the new Ganges Division, which comprises the submontane forests of the Garhwál District near the Ganges, as well as the Chándi Forest in the Bijnor District; and on the 29th I had the privilege of meeting Mr. H. F. D'O. Moule, the Collector of Bijnor.

On the 1st April I crossed the Ganges to Hardwár, where I commenced my inspection of the School Forests, in company with Dr. W. Schlich, the Conservator of the Punjab, and Major F. Bailey, R.E., the Director of the Forest School. The inspection of the Patri Forest, south of Hardwár, and of the outer Siwálik Forests, in the Saháranpur District, occupied from the 1st to the 6th April. After inspecting the Dehra Dún Forests, and spending some time at Dehra, we reached Chakráta on the 27th, and, after examining the forests of the Jaunsár and Tons Divisions, reached Roru in the Pábar Valley on the 14th May.

2. The Report contains a detailed account of the forests visited. This account is based upon the observations made during the present tour, during an inspection of these forests made by me from December 1874 to March 1875, a tour through the Gorakhpur Forests in November 1864, and a detailed examination of the forests of Oudh and the North-Western Provinces from March to June 1863. Chapters IX to XII relate to the forests of the School Circle, which were inspected jointly by Dr. Schlich and myself as Members of the Board of Inspection appointed by the Government of India; and these chapters may be regarded as our Joint Report regarding these forests.

Forests in the Himalaya.

3. As regards their constitution, the forests described in the present Report belong to two great classes—the forests on the higher hills of the Himalaya, in the Jaunsár and Tons Divisions, and the submontane and Siwálik Forests. Besides the hill forests on the Tons River and its affluents, which are described in the present Report, there are, in the territories under the Government of the North-Western Provinces and Oudh, the following forests in the hills, under the control of the Forest Department:—the forests on the Jumna and Bhágirathi Rivers in the Tiri State, and the forests in the vicinity of the stations of Ránikhet and Naini Tal. The object of undertaking the systematic management of these hill forests is two-fold—to provide a permanent supply of timber, chiefly deodar, to the plains, which is floated down the Jumna and Ganges Rivers, and to furnish a permanent supply of timber and firewood to the stations of Chakráta, Ránikhet, and Naini Tal. There is also the further object of providing for a permanent supply of wood and other forest produce to the agricultural population in the vicinity of the forests. In these hills, however, where population is as a rule scanty, this further object has not yet acquired any great practical importance.

4. For export to the plains deodar is the only wood for which there is a steady demand on a large scale on the rivers mentioned. The demand for chír *(Pinus longifolia)* is growing, but is as yet limited.

The local requirements of the three stations mentioned are provided for by a large variety of woods, among which deodar, chír, the spruce, and the silver-fir, and three species of oaks (*Quercus incana, dilatata, and semecarpifolia*), are the most important. From the Forester's point of view, the study of the growth, habits, and requirements of the species mentioned is a necessity, and the present Report will be found to contain some contributions to our knowledge on these points.

Forests on the outer hills and in the plains.

5. The submontane and Siwálik Forests are exceedingly extensive. They constitute a belt 450 miles long, extending from the Jumna to the Ganges,

from the Ganges to the Sárda, and from the Sárda to the Great Gandak River, and their area is as follows:—

			Square miles.	
1. Oudh Circle	(1) Gorakhpur Division	...	115	
	(2) Gonda „	...	143	
	(3) Bahraich „	...	257	
	(4) Kheri „	...	263	
	(5) Bhira „	...	164	
	(6) Pilibhít „	...	137	
				1,079
2. Central Circle	(7) Kumaun „	...	635	
	(8) Garhwál „	...	472	
	(9) Ganges „	...	173	
				1,280
3. School Circle	(10) Saháranpur „	...	298	
	(11) Dehra Dún „	...	278	
				576
		Total	...	2,935

6. To these must be added the forests in the Tarái District of the Kumaun Division, which, though not under the Forest Department, and not notified as reserved forests under the Forest Act, are yet demarcated and efficiently protected. They consist of eight blocks, with the following area:—

		Square miles.
1.	Makonia	... 1
2.	Kilauli	... 10
3.	Sarapu	... 5
4.	Kukrálá	... 13
5.	Dimri	... 9
6.	Kilpuri	... 32
7.	Debipura	... 3
8.	Bilheri	... 68
	Total	... 141

Forest assigned to the Kumaun Iron Works.

7. The long belt of Government forest at the foot of the Himalaya is not, however, continuous; it is interrupted between Rámnagar and Haldwáni by a large extent of forest, which, though not alienated by Government, can hardly be said to be under its control. These are the forests assigned to the Kumaun Iron Works, commonly known as the Kumaun Iron Company's Grant.

The area of this tract of country is 205 square miles, and a large portion of it is forest. An agreement between the Company and Government is said to be in existence, setting forth the conditions under which certain rights have been assigned in this area to the Kumaun Iron Company. This agreement I have not seen, but, from the information which I have obtained, I gather that the following are its main provisions. The villages situated within the tract are permitted to clear forest land for cultivation under the ordinary rules, and, as a matter of fact, cultivation is steadily extending and the forest area is diminishing. The villagers have also the right to graze cattle and to cut wood for domestic and agricultural purposes within these forests. Subject to these provisions, the Kumaun Iron Company may cut and use wood for iron smelting. They are not permitted to sell the wood, or otherwise to make revenue from the forests.

In 1875 an examination of the forest situated outside the hills was made, and the area of this portion was then estimated at 80 square miles.

Forests on the outer hills.

8. As regards elevation, the submontane forests of Oudh and the North-Western Provinces extend from the level of the plains to about 4,500 feet on the outer ranges of the Himalaya. As regards general character and treatment, we must distinguish between the forests on the hills and on level ground.

In both classes sál is the tree for which there is most demand, and which is, therefore, most important. On the hills below 2,000 feet sál not often forms pure forests over any large extent of ground, but is mixed with a great variety of other trees and often with bamboos. The tree is found, though poor and stunted, as high as 5,000 feet, but does not generally form valuable forests at elevations exceeding 3,000 feet. At 2,000 feet and upwards sál often predominates over the other kinds and not rarely forms nearly pure forests. At such elevations, however, sál neither attains any great girth nor great length of bole.

A peculiar feature of these hill forests is that *Buchanania latifolia* (perua) is often gregarious and occupies large areas. Another tree which is common on the hills and rare on level ground is sándan *(Ougeinia dalbergioides)*. This also occasionally shows a tendency to be gregarious, but by no means to the same extent as in the forests of Central India.

9. On the inner edge of the hill forests the rock is the shale or slate of the outer Himalaya, while outside there is the broad belt of the soft sandstones and conglomerates of the Siwáliks.

The forest on the hills which belong to the Siwálik formation generally contains less sál than the forest further inland. The crests of these Siwálik Hills are frequently stocked with chír, and the slopes bear a thin and open forest of *Anogeissus latifolia* and other trees. The aggregate area of the forests on hilly ground may be estimated at 1,206 square miles.

Forests on level ground.

10. The forests on level ground may be divided into two great classes—those outside the hills in the plains, and those at the foot of the hills and in the dúns or broad valleys which form so marked a feature in the configuration of this part of the country.

With the exception of a portion of the Gonda Forests at the foot of the Tulsipur Hills, the whole of the forests of the Oudh Circle are out in the plains and entirely away from the hills. Indeed, some outlying forest tracts in Gorakhpur, Gonda, and Kheri are situated on high ground in the midst of the open country, at a distance from the foot of the hills (which are here in Nepál) of from 60 to 70 miles. In the Central Circle and the Tarái District, between the Sárda and the Ganges Rivers, the following forest tracts are situated entirely outside the hills :—

	Square miles.
Tarái District Forests	141
Blocks in East Kumaun, outside the hills	50
Garhi Bulchand Forest	17
Rehar	24

In the Saháranpur District, west of the Ganges, there are only the Patri Forest and a small area outside the Siwáliks, the area of which may be estimated at 50 square miles.

The whole of the submontane forests here mentioned, including those in the Tarái District, may thus be classified as follows :—

	Square miles.
On hilly ground	1,206
On level ground in the dúns and at the foot of the hills ...	510
Outside the hills	1,360
Total ...	3,076

This is put forward merely as a rough estimate. It will be useful to work it out in detail hereafter.

Sissoo and Khair forests.

11. On level ground, whether in the dúns or outside the hills, one class of land merits special attention. These are the broad beds of shingle, sand, and boulders through which the mountain streams make their way, which are found in all valleys, and which extend from the foot of the hills far out into the plains.

The forest in these places is of a character entirely different from the forest on the high ground. The most important trees are sissoo and khair, both gregarious, either together or alone, forming forests, more or less pure, of sissoo and khair. These two species occur in the valleys high up into the hills, and large quantities of their seed, which ripens during the dry season, are washed down by the flood, and are deposited, as the waters subside, on freshly formed islands and banks, where the young plants spring up in large masses together. These belts of shingle and boulders are often several miles wide, and when the ground has remained undisturbed for some time other species settle and give the forest a more mixed character. The most common of these are *Casearia tomentosa*, *Ulmus integrifolia*, and *Moringa pterygosperma*. But these mountain streams shift constantly and change their course, cutting through the forest and throwing down thousands of trees. The result is a natural but irregular system of rotation and successive belts of khair and sissoo, representing a gradation of ages, saplings, poles, and mature trees. The streams cut indiscriminately through the forest, rooting up saplings, poles, or mature trees, as they happen to be in the way. In exceptional cases only do the sissoo or khair trees attain full size in such localities. There are, however, forest tracts with a large number of mature trees of these species, which have not been cut into by the streams for a long time. Such tracts, with mature sissoo timber, are not uncommon in the Oudh Forests, in the vicinity of the Sárda, Suheli, and Kauriála Rivers; and mature khair trees are found in many parts of these submontane forests. But the great mass of the khair and sissoo forests are young, and are constantly cut down by the erratic currents of the streams long before the trees attain maturity.

12. For khair there is a sufficient demand—for sugar-mill pestles and for the manufacture of catechu—throughout the whole length of the forests; indeed, in the forests between the Ganges and Kosi Rivers, which form the Ganges, Garhwál, and part of the Kumaun Divisions, the tree has been overcut and the resources of mature khair timber are nearly exhausted.

For sissoo the demand is equal to the production in Saháranpur and the Dehra Dún, as well as in Oudh and in the forests between the Ganges and Kosi Rivers. In Kumaun, however, between the Kosi and Sárda Rivers, the demand is not at present sufficient to consume the enormous quantities of sissoo timber which are annually uprooted by the changing course of the mountain streams. But here also the demand is increasing steadily.

Sal forests on high ground.

13. It now remains to say a few words regarding the large extent of forest which occupies the belts of high ground at the foot of the hills, and between the stretches of khair and sissoo which occupy the low-lying land in the immediate vicinity of the streams.

In this forest sál is the principal tree wherever the soil is suitable—that is, wherever it contains a sufficient admixture of sand or shingle and boulders. Where the soil is binding, and where clay prevails, other species get the upper hand. Under certain circumstances it is sáj *(Terminalia tomentosa)*, and in other cases it is tendu *(Diospyros Melanoxylon)*. Sáj predominates over a large tract in the north corner of the Motipur Forest, and the Bhinga Forest furnishes a most remarkable instance where tendu predominates. Near the foot of the hills, on rising and somewhat undulating ground, sál is often wanting, and here dhaura *(Anogeissus latifolia)* is* frequently the chief tree. This is well exemplified in the Tulsipur Forests of the Gonda District.

It should also be mentioned that mixed forest, generally with a large proportion of thorny scrub, is common along the lower edge of the forests in the plains, and often occupies considerable areas; and that stretches of low ground, or, as in the Bhira Forest, of poor sandy soil, are occupied by open grass lands, which form extensive enclosures in the forest.

Broadly speaking, it may be said that on high ground, where the soil is suitable, sál predominates; while on stiff binding soil, on undulating ground and at its lower edge, the forest is generally of a mixed character.

* In Oudh dhaura is *Anogeissus*, while west of the Sárda River dhaura is *Lagerstrœmia*.

14. Comparing the sál in the dúns and on the high ground skirting the hills, with the sál in the plains outside the hills, it must be said that in the first named forests the tree attains a larger size, and that the stems are taller and better shaped than outside. Hence it follows that the forests in the dúns and on the high ground skirting the hills, though less extensive than the forests on the hills or in the plains outside the hills, have a special value. To this class belong the forests in the Nindhaur Valley, part of the Kotah Dún, and the forests on the flats along the Kosi River; the Pátli Dún Forests in the valley and on the flats near the valley, including Shísham Khata; the Jogichaur Forest on the banks of the Ganges; the Lachiwála and Tháno Forests, as well as several others, in the Dehra Dún. These are the tracts in which fire-protection pays best, and where it should be continuously maintained.

There are some forests on the hills which, as regards value, nearly equal those on the flats and in the dúns. Instances are the Durgadeh Forest in Kumaun, the forest on the north side of the hill range which separates the Adnála from the Haldgadi streams, and part of the Kohtri Dún Forests in Garhwál. But such cases are rare, and the forests on level ground have always the great advantage of easier export and more complete natural regeneration of the sál.

In the plains it may generally be said that the shape and length of stems and the size of the trees are better the less the distance from the hills. In forests of sál in the open country, at a great distance from the hills, such as the Nawábganj Reserve in the Gonda District, the poles are crooked and badly shaped, and this may most probably, to a great extent, be ascribed to the action of the hot winds, while the absence of the hot winds in the dúns favours the healthy development of the tree.

Trees associated with Sal.

15. A few words should now be said regarding the associates of sál. Referring to what has already been mentioned regarding sáj, tendu, dhaura, and sándan, it may be added that there is great uniformity in the species associated with sál throughout the entire extent of these submontane forests. *Lagerstræmia parviflora*, *Schleichera trijuga*, *Eugenia operculata*, *Buchanania latifolia*, *Holarrhena antidysenterica*, and *Semecarpus Anacardium* are rarely absent; while of creepers *Spatholobus Roxburghii*, *Bauhinia Vahlii*, and *Millettia auriculata* are common companions of sál. The creepers have fortunately been extirpated over large areas, partly by cutting and partly by the more dense cover overhead, which does not afford light enough for these plants to develop their climbing habits. In certain localities mohwa (*Bassia latifolia*) is common, for instance in the Nawábganj Reserve in Gonda, in several compartments near Dudua in Kheri, and on certain flats on the right bank of the Kosi River below Mohán. *Adina cordifolia* is common locally, as in Bhinga and Motipur.

The only other remark which is called for in regard to the associates of sál in these forests is that certain trees are found in company with sál in the Oudh Forests which are not found further west. Of these the most noteworthy are *Dillenia pentagyna* and *aurea*, *Heynea trijuga*, and *Miliusa velutina*, which last is found, though rare, as far west as the Ganges.

Demand for timber and forest produce.

16. The submontane forests here described provide grazing for large herds of cattle which come up from the plains, and they supply the open country of the Doáb, Rohilkhand, Oudh, and the Benares Division with timber, wood, bamboos, and other forest produce. Between the Ganges and Sárda Rivers the Government forests are the most important source of supply. In the Dehra Dún there is a considerable forest area in private hands, but these private forests are being worked recklessly and their resources will sooner or later be exhausted. It is different east of the Sárda River. Here the Government forests of Oudh and Gorakhpur are the outskirts only of extensive forests situated in Nepál, which are stocked with an abundance of excellent timber, large and of regular shape. It often happens that timber from Nepál

is brought from across the frontier and is carted through the Trans-Sárda Forests of Kheri, which are among the best in Oudh; and the contrast beween the beautifully round and straight logs which are brought from Nepál and the timber produced in Oudh is very remarkable.

Yet, notwithstanding this competition from Nepál and the private forests in the Dehra Dún, there is a great demand for the produce of the Government forests.

Sal.

17. The difficulty is the scarcity of large timber, most of which has been cut out during the last fifty years. The proposals of the present Report, if accepted, provide for the export of limited quantities annually of mature timber, which will supply the market sufficiently until the trees of the younger classes have attained maturity. These supplies of large timber will chiefly be drawn from the Bhinga, Motipur, and Kheri Forests in Oudh, from the Nindhaur and Kosi Valley Forests in Kumaun, and from the Pátli Dún Hill Forests in Garhwál.

As regards the management of sál forests, the chief desideratum is an accurate knowledge of the rate of growth of the tree. Annual rings cannot with certainty be distinguished, and nothing therefore remains but to institute a regular system of measuring selected trees annually. A good plan for doing this has been initiated by Captain Wood in Oudh, and suggestions for carrying on these measurements on a systematic plan in all three Circles will be found in the present Report. As far as the observations made in Oudh have gone, they indicate a much more rapid growth of the sál tree than that hitherto assumed. Of this the practical result is that if fire conservancy is extended to all tracts required for the production of timber, and if it is steadily maintained in those tracts so as to ensure the complete regeneration of the forest, it will be possible to cut on a very large scale as soon as the trees of the smaller classes have attained full size. At present the quantity cut is necessarily limited by the quantity of mature timber available, which must be made to last until the smaller classes have attained full size.

Timber of other kinds.

18. For khair, sándan, and sissoo a sufficient demand already exists as a rule. For timber of other kinds—such as haldu, sáj, dhaura, and bákli—the demand is limited, but it is increasing steadily. In the vicinity of the Ganges River, especially on the east side, almost any quantity of timber of other kinds can be sold, and there is a large export of such timber from the Kumaun Forests outside the hills to Pilibhít and Bareilly.

Bamboo.

19. The bamboo of these forests is all the common Indian bamboo *(Dendrocalamus strictus)*. The large thorny bamboo *(Bambusa arundinacea)* is found to a limited extent in Kumaun, outside the hills, and in the Motipur Forest of Oudh. The largest export of bamboos is from the forests between the Ganges and Kosi Rivers, and here special measures have been suggested in the present Report in order to ensure a permanent and sufficient supply of good and large bamboos. These measures are detailed in Chapter VII, which treats of the forests in the Garhwál Division.

In the bamboo forests of the Saháranpur Division a series of experiments has been commenced, in order to determine the effect of fire-protection upon the development of the bamboo, and the effect of cutting out annually a larger or smaller number of stems from a clump.

A remarkable fact is that there is no export of bamboos from the Nepál Forests north of Oudh, although the bamboo is said to be plentiful on the outer hills in Nepál.

Bhabar.

20. The export of the grass known as bhabar, bhaib, bankas *(Andropogon involutus*, not, as has often been erroneously stated, *Eriophorum comosum)*,

from the Siwálik Hills and from tracts of broken raviny ground outside the hills, is very considerable from nearly all parts of the forests treated in this Report. The grass grows abundantly on dry bare slopes, and no apprehension regarding the sufficiency of the supply need at present be entertained. It is used chiefly for rope-making, and it is by no means impossible that the establishment of paper-mills in North India will eventually lead to the employment of this grass for the manufacture of paper.

Grazing and Forest Villages.

21. Large areas of the submontane forests are only fit for pasture, and they are utilized by large herds of cattle which annually come up from the open country, some from the immediate vicinity of the forests and others from great distances. As a rule, the cattle graze in the forests during the cool season, from November until April; but there are some tracts, such as the Bhinga Forest, where circumstances are peculiar and where pasture continues throughout the rains. Forests with heavy pasture are, as a rule, fired in the hot season, in order to stimulate the growth of young grass. Hence the proper policy will doubtless be to effect a separation between the areas reserved for the production of timber and those which are to be used chiefly for pasture. All the suggestions of the present Report tend in this direction. This process of separation must be gradual, and it must necessarily go hand in hand with the extension of fire conservancy.*

Within the limits of the forests here described there are many places which, at one time or other, were cultivated and inhabited, and in many instances such localities are not likely ever to become stocked with valuable forest. As the selection of the areas set apart for the production of timber progresses, it will probably be found possible to lease out the lands suitable for cultivation and to encourage the establishment of villages in the forests. Due precautions must, as a matter of course, be taken to guard against injury to the forest set apart for the production of timber, and this can be assured by assigning to each village a suitable area of forest land in its immediate vicinity for the pasture of cattle and the provision of wood and other forest produce. At first sight this seems a bold measure to propose, and each step in this direction must be taken with the greatest caution. These forest villages must not of course be permitted to degenerate into cattle stations requiring larger areas for pasture than those assigned to them for that purpose. The control of these forest villages in all matters pertaining to land tenure and revenue should remain with the Forest Officers. The greatest attention should be paid to the establishment of a good system of agriculture, and, if this is done, these forest villages may become models to the villages outside the forests, which naturally cannot receive the same share of time and attention by intelligent and well-trained officers.

Forest Ranges.

22. It will be useful here to state the Forest Divisions and Ranges into which the forests here described, as far as they are under the Forest Department, are, or should be, divided :—

Forest Division.	Civil District.	Range.	Area, in acres.
	OUDH CIRCLE.		
1. Bahraich ...	Bahraich ...	(1) Bhinga ...	73,600
		(2) Motipur ...	90,880
2. Kheri ...	Kheri ...	(3) Khairigarh ...	78,720
		(4) Newalkhar ...	89,600
3. Pilibhít ...	Kheri ...	(5) Bhira ..	97,891
	Pilibhít ...	(6) Púranpur ...	65,361
		(7) Pilibhít ...	29,434

* In the Appendix to this Report will be found a letter of the 23rd April last, from Captain Wood, the Conservator of the Oudh Circle, to the Government of the North-Western Provinces and Oudh, bearing upon this subject.

Forest Division.	Civil District.	Range.	Area, in acres
	CENTRAL CIRCLE.		
4. Kumaun ...	Kumaun ...	12 Ranges ...	35,000 (average.)
5. Garhwál ...	Bijnor ...	(20) Rehar ...	22,000
	Garhwál ...	(21) Dháron ...	37,120
		(22) Sona Nadi ...	58,240
		(23) South Pátli Dún	30,080
		(24) North Pátli Dún	58,240
		(25) Palain ...	40,960
		(26) Kohtri Dún ...	42,880
6. Ganges ...	Garhwál ...	(27) Udepur ...	34,240
		(28) Gori ...	56,320
	Bijnor ...	(29) Chándi ...	20,882
	SCHOOL CIRCLE.		
7. Saháranpur ...	Saháranpur ...	(30) Eastern ...	35,085
		(31) Central ...	80,040
		(32) Western ..	75,571
	Dehra Dún ...	(33) Eastern Siwálik	42,301
		(34) Eastern Dún ...	33,231
		(35) Central „ ...	48,096
		(36) Western „ ...	54,151
8. Jaunsár ...	Dehra Dún ...	(37) Southern ...	8,314
		(38) Deoban ...	35,363
		(39) Bawar ...	33,063
9. Tons ...	Leased Forests ...	(40) Deogar ...	14,758
		(41) Deota ...	24,036
		(42) Lambatach ...	7,075
		(43) Busáhir ...	.....

Besides the nine divisions described in this Report, there are, in the North-Western Provinces and Oudh, the Jhánsi, Lalitpur, Naini Tal, Ránikhet, Gonda, and Gorakhpur Divisions—total 15 divisions—which, when their organization has been completed, will be divided into, say, 50 forest ranges or executive charges, with areas ranging from 20,000 to 100,000 acres. At present, most of these forest ranges are in charge of Foresters, and this explains why there are at present only nine Forest Rangers on the staff of the North-Western Provinces and Oudh. The monthly cost of the present Rangers is Rs. 540, and, with a more complete gradation, the cost of 50 Rangers would probably amount to Rs. 4,000 a month, or Rs. 48,000 a year. So large an increase in the establishment charges can, as a matter of course, only be effected gradually, as the forest revenue increases; but it is well to keep in mind that eventually a complete staff of Forest Rangers, with pay on a regular graded scale, ranging, within the prescribed limits, from Rs. 50 to Rs. 150 a month, must be established.

The Forest School has now been set on foot with the view of giving a sound professional education to persons who desire to become Forest Rangers, and the next move must be to organize in each Circle a staff of Forest Rangers on rates of pay and prospects of promotion sufficient to induce candidates with good education to enter the Forest School with the view of obtaining the Forest Ranger's certificate.

Rest-houses.

23. Proposals for the construction of forest rest-houses in several places have been made in this Report, and it is well to agree upon a uniform pattern. The rest-houses built in Oudh by Captain Wood, the Conservator, are on a good and economical plan, and they are suitable for most of the submontane forest divisions of these provinces. They are of three classes: the first and second classes are double-storied, costing Rs. 3,500 and Rs. 2,625, respectively, while the houses of the third class (Rs. 550) consist of one story, with a large thatched shed built over the tiled roof. Plans, specifications, and abstracts of cost of the three patterns are appended to the present Report, and they may be found useful in other provinces also.

The provision of good shelter and healthy accommodation for officers and subordinates in the forests is a most important work. Good rest-houses do more than anything else to save the time and health of Forest Officers, and fire conservancy particularly is greatly facilitated by the provision of good shelter for Forest Officers during the hot season.

CHAPTER II.

NAWABGANJ FOREST.

24. The road from Nawábganj to Utraula passes through a stretch of high ground situated north of a large tract of low land intersected by numerous *jhils*, which probably indicate one of the former courses of the Gogra or Sarju River. This stretch of high ground may be regarded as the western end of an extensive tract of high ground in the district of Basti. The greater portion of this tract of country was originally forest, and at the disposal of Government. About the year 1860 large areas were given out as grants for cultivation. At an earlier period extensive grants of similar land had been made in the adjoining district of Basti. These have been completely cleared and brought under cultivation, while most of the grantees in the adjoining portions of the Gonda District have been unsuccessful. Hence a number of these grants were thrown up or resumed. One of these, the Rámgarh grant, was, in 1870, made over to the Forest Department, and to this were added, in 1880, two other grants north of it, Shambhunagar and Jaipur; and regarding four others, which are situated east of Rámgarh, a notification has been published, under section 4 of the Indian Forest Act, declaring that it is proposed to constitute them as reserved forest.* The whole of this area was originally made over to the grantees by Government free of rights of third persons.

Area.

25. The stretch of reserved forest here described is proposed to be designated the Nawábganj Forest, and its area appears from the following abstract:—

Areas already declared as reserved forest.

	Acres.
Rámgarh	2,447
Jaipur	954
Shambhunagar	795

Areas notified under section 4 of the Indian Forest Act.

Sajui	2,071
Moneypur	2,542
Glynn Grant	826
Jankinagar	1,278
Total area ...	10,913

Importance of the forest.

26. The Nawábganj Reserve, if constituted as now proposed, will be bounded on the south and east by the boundary of the Basti District and the Ladhena grant. The Fyzabad-Utraula road passes through the western portion. Most of the forest land which adjoins the reserve is in progress of being cleared; hence it may be expected that these 10,913 acres of forest will some day be of very great importance for the supply of the adjoining open country and the station of Fyzabad.

Present condition.

27. The Rámgarh block has been protected since 1870 against grazing, and since 1875 against fire. When the land was taken over by the Forest Department, all the large trees, with the exception of mohwa (*Bassia latifolia*), had been cut down, and even a number of mohwa trees had been felled for building purposes and for sale. The ground was stocked with grass and with young sál 6 to 10 feet high. On the 31st January 1881, I examined the Rámgarh block, and found the forests on high ground in a very satisfactory condition and fairly stocked with poles, chiefly of sál, averaging 30 feet in height. Under these the ground was covered with dry leaves, and the upper part of the poles was smooth and clean, proving that no fires had occurred for some years.

* The entire Nawábganj Forest has since been declared a reserved forest under the Act.

Sal poles not straight.

28. These sál poles, however, though they will be exceedingly useful and valuable, are by no means as straight as those of the northern forests in Oudh, near the boundary of Nepál. They have numerous bends and twists, although they have, as stated, grown up on areas protected from fire. In forests which are subject to annual fires, the irregular shape of the sál poles is justly ascribed to the action of the fire, which kills the terminal shoot and lateral branches, and thus causes the formation of knots and bends in the stem, but in the present case the irregular growth must be ascribed to causes other than the action of fires.

The study of the growth of sál poles in this forest, as well as in other forests situated in the open country at a distance from the foot of the hills, and exposed to the full action of the dry westerly winds of the hot season, seems to lead to the conclusion that the action of these hot westerly winds is, in some respects, similar to that of the annual jungle fires. Frost also in some cases causes a knotty and irregular growth of the sál poles. The soil of the high ground in the Rámgarh Forest is a poor sandy loam, and as it improves by means of fire-protection continued for a long series of years, it may be expected that the growth of the poles will improve likewise. A few large sál trees are left, but these are all forked, crooked, or hollow.

Mohwa.

29. Besides sál, the chief tree is mohwa, of which there is a large number of all sizes, so much so that in places it is now the principal tree. This tree has been spared because its flowers and seed are exceedingly valuable. The stems of the younger trees have been well drawn up by the sál poles surrounding them, and they are likely to grow up and to form well-shaped timber. The remarkable point in this matter is that there are hardly any mohwa seedlings on the ground, while the forests are full of young growth of sál. It is a question for future study whether mohwa seedlings do not come up on account of the shade, or whether the seed is so completely picked that none remains. The flowers of this tree, it will be remembered, fall to the ground after the young seed has commenced to form, so that the collection of the flowers in no way interferes with the development of the seed.

Other trees.

30. Of the other kinds of trees, the following were noted :—

Dillenia aurea	Aggai.
Saccopetalum tomentosum	Karri.
Flacourtia sapida	Kantái.
Ægle Marmelos	Bél.
Zizyphus xylopyra	Chitaina.
Schleichera trijuga	Kusum (scarce).
Semecarpus Anacardium	Bhila.
Buchanania latifolia	Perua.
Bauhinia purpurea	Koilára.
Bauhinia Vahlii	Mauhrain.
Cassia Fistula	Urga.
Terminalia bellerica	Bahéra.
Terminalia Chebula	Harra.
Terminalia tomentosa	Asna.
Anogeissus latifolia	Banjhi.
Eugenia operculata	Dugduia (scarce).
Lagerstræmia parviflora	Assid.
Randia dumetorum	Maini.
Randia uliginosa	Peirar.
Diospyros Melanoxylon	Tendu.
Holarrhena antidysenterica	Dudhi.
Stereospermum suaveolens	Párar.
Phyllanthus Emblica	Aonla.

Stretches of low ground.

31. The high ground in the Rámgarh grant alternates with large open depressions stocked with grass, the chief of which is in the centre of the forest, stretching from north-west to south-east. Some of these depressions were at one time under rice cultivation, but the ground is poor. The grass on these lands sells readily for thatching, and it is taken out by the people of the

surrounding villages at the rate of two annas a two-bullock cart-load. I am inclined to think that some of these low lands might with advantage be let out for rice cultivation, due precaution being taken to guard against injury to the forest.

Fire-protection.

32. No difficulty has as yet been experienced in fire-protection. The River Chamnai forms a good protection, and on the west and south sides there are private forests, which are burnt annually.

The cutting of lines has just been commenced, and it is intended to cover the whole forest with a network of roads to facilitate fire conservancy and the export of wood and other produce, as has been done in the other forests of Oudh.

The success in fire-protection is chiefly due to the energy of the Forest Guard, Hingun Khan, who has been in charge of the Rámgarh Forest ever since 1870.

Revenue and Expenditure.

33. The revenue of the forest during the last three years has been as follows:—

Items.	1877-78.	1878-79.	1879-80.
	Rs. A. P.	Rs. A. P.	Rs. A. P.
Mohwa	83 12 0	7 12 10	65 11 5
Thatching grass	63 0 0	83 12 0	168 8 10
Miscellaneous	11 6 0	16 11 11	89 9 6
Total ...	158 2 0	108 4 9	323 13 9

The expenditure, besides the pay of the two Forest Guards, which aggregates Rs. 16 per mensem, has hitherto been insignificant. As regards future treatment, protection is the chief thing wanted; and until the forests on the surrounding land have been completely cleared, I do not recommend any extensive fellings. Efforts must be made to increase the revenue from mohwa and thatching grass as much as possible.

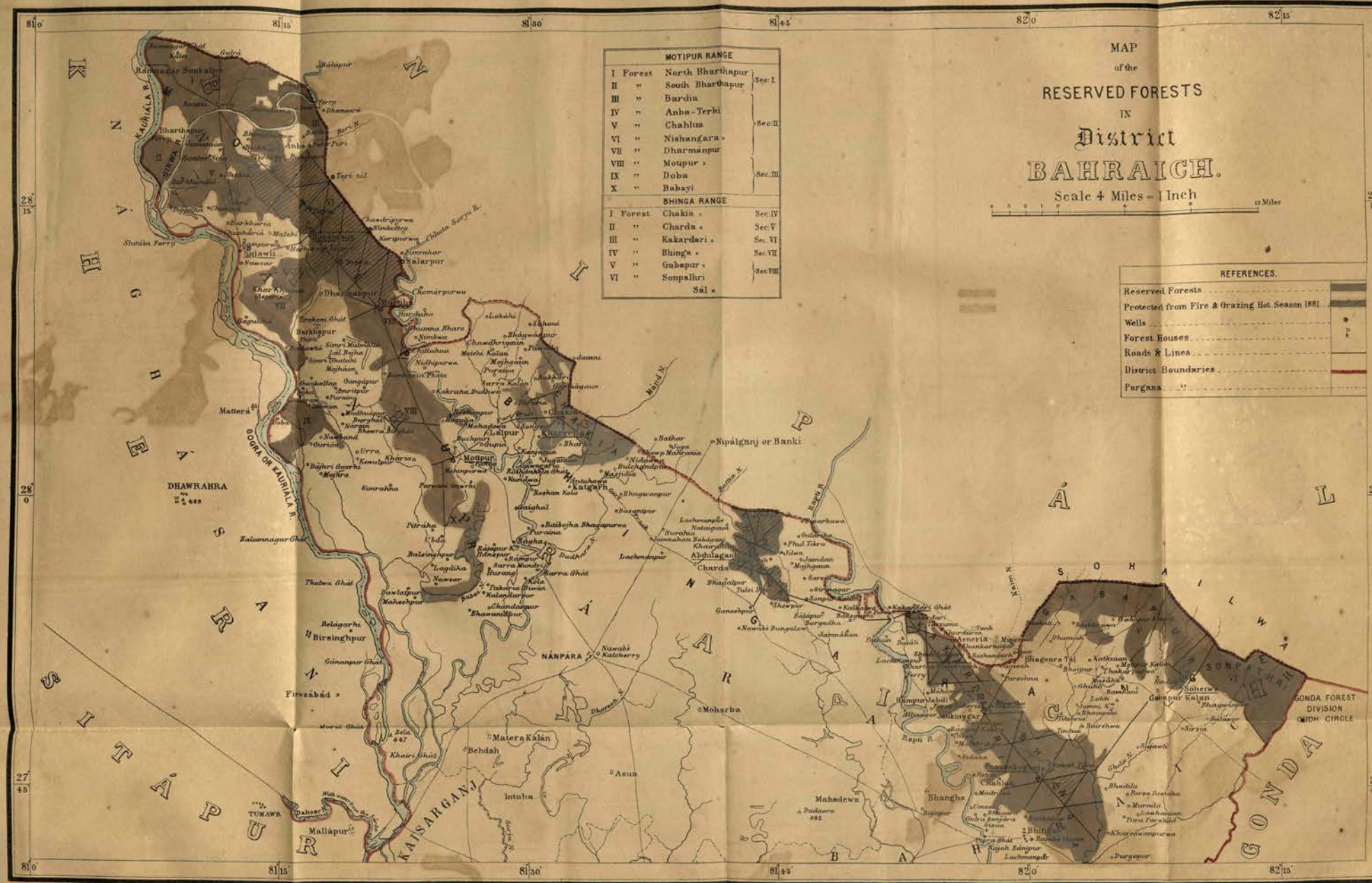
CHAPTER III.

FORESTS IN THE BAHRAICH DISTRICT.

Bhinga Forest.

34. Between the Rápti River on the west and the Kaim Nala, a tributary of the Rápti, on the east, is a stretch of high ground occupied by the Bhinga Forest, the area of which is about 60 square miles. It extends southward, from the Nepál boundary at Kakardari, for a length of 18 miles, with an average width of 3 to 4 miles. This forest is chiefly stocked with sál and tendu, and its peculiar character is that the soil at the surface is generally a stiff loam, and that it is and has been, for many years past, overrun by an immense number of cattle.

ROYAL ASIATIC SOCIETY
LIBRARY
OF THE
BOMBAY
BRANCH
OF THE


MAP
of the
RESERVED FORESTS
IN
District
BAHRAICH.
Scale 4 Miles = 1 Inch
0 1 2 3 4 5 6 8 12 Miles
MOTIPUR RANGE
I Forest North Bharthapur Sec: I
II " South Bharthapur
III " Bardia
IV " Anba-Terhi Sec: II
V " Chahlua
VI " Nishangara
VII " Dharmanpur
VIII " Motipur
IX " Doba Sec: III
X " Babayi
BHINGA RANGE
I Forest Chakia Sec: IV
II " Charda Sec: V
III " Kakardari Sec. VI
IV " Bhinga Sec. VII
V " Gabapur Sec: VIII
VI " Sonpalhri
Sál
REFERENCES.
Reserved Forests
Protected from Fire & Grazing Hot Season 1881.
Wells
Forest Houses
Roads & Lines
District Boundaries
Pargana "
KHERI
SITAPUR
BARAICH
GONDA
DHAWRAHRA
Matterá
Nánpára
Kaisarganj
Tumawr
Mallápur
Nipálganj or Banki
Moharba
Matera Kalán
Behdah
Intuha
Asun
Mahadewa
Bhangha
Chahla
Gabapur Kalán
Soheiwa
Sonpalhri
GONDA FOREST DIVISION OUDH CIRCLE
Drawn in the Forest Survey office by Babu Jadunath Nath from a Map supplied by Captain Wood Conservator of Forests Oudh Circle N.W.P. Sep: 1881.
Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún, September 1881.
C. Lyon, Photo.
C. G. Gillenhaal, Recon.

Absence of grass.

35. Except in the blocks now closed against grazing, there is, as a rule, no grass on the ground, and there is hardly any young growth of sál. The contrast between the Bhinga Forest and that belonging to Kapurthala near Ikauna* is very remarkable. In the latter there is a good crop of grass on the ground, and, where the soil is suitable, there is a fair growth of sál.

At first sight it is difficult to understand that the grazing should be heavier in the Bhinga than in the Ikauna Forest, the latter being situated more in the open country. The difference is this, that the Ikauna Forest is surrounded by extensive areas of waste land which are used for pasture, while the Bhinga Forest is the only grazing ground available in the immediate vicinity of the villages adjoining it. On the north-east side, between it and the forests at the foot of the Nepál Hills, is a belt of open country, about six miles wide, almost entirely occupied by rice fields. The villages in this tract have no pasture during the rains, and send most of their cattle into the Bhinga Forest. Again, the villages between it and the Rápti River have no grazing grounds except the forest. A remarkable feature regarding the pasture in the Bhinga Forest is that it is frequented during the rains by large herds of cattle. In Khairigarh, Motipur, and other forests of Oudh, the large gadflies are so bad that the cattle have to leave at the first burst of the monsoon. In Bhinga, on the other hand, the forest swarms with cattle during the monsoon.

No young growth of Sal.

36. The almost entire absence of young growth of sál in this forest is very remarkable. It was noticed as far back as 1864, and must, to a great extent, be attributed to the large number of cattle in this forest during the rains, which eat the seed as it falls in June and destroy any seedlings which may have come up. Besides this, the surface is converted into a hard pan by the tread of the cattle during the rains, and thus the seed, though it may germinate, has no chance of succeeding. Besides the action of the cattle, the nature of the surface soil has doubtless considerable influence in preventing the free growth of young sál. Colonel W. Stenhouse, while officiating as Conservator in Oudh, wrote as follows in his Report (paragraph 44) for 1870-71 :—

> " It may here be added that it may be necessary, in the lower levels of the section, to cut drains into the Rápti River to prevent the lodgment of water, which is so fatal to the young plants, and to scatter sál seed in other places where seed-bearing trees are deficient in number."

Soil.

37. The soil of the Bhinga Forest, down to a considerable depth, consists of alternate strata of sand and clay, but near the surface clay or stiff loam predominates. These successive strata were clearly seen in a well recently excavated in the northern part of the forest, at the junction of three roads near the village of Jabdi Kót. The following were the strata noticed from the surface to the bottom of the well :—

Strata.	Thickness of stratum.
Clay and stiff loam	9 feet.
Clay and kankar	3 „
Sand	2 „
Clay and kankar	1 foot 6 inches.
Sand	3 feet.
Clay, with a little sand	2 „
Clay and kankar	3 „
Clay	5 „
Sand	4 „ 6 inches.
Total depth of well	33 feet.

* See Appendix III.

This instance may be taken as a fair specimen of the strata of the subsoil in this forest. It shows that near the surface, and to a depth of 28 feet 6 inches, clay predominates. The only exception is to be found in the vicinity of the Kaim Nala, where large masses of sand have been deposited on the surface. In the rest of the forest the surface soil, as already stated, is a stiff loam, and in this respect it presents a marked contrast to most of the other sál forests of northern Oudh and the Pilibhít District, the soil of which is generally a light sandy loam.*

Present stock of Sal.

38. The present stock of old and middle-aged sál in the Bhinga Forest, which is considerable, can only have come up at a time when the country in its immediate vicinity was uninhabited, or much less inhabited than it is at present. Since the country has become quiet—that is, chiefly since the Mutiny—cultivation has increased very rapidly, and large areas of grass land in the vicinity of the forest have been brought under the plough within the last ten years.

The sál tree, although it prefers a lighter soil, will nevertheless grow well on stiff loam like that of the Bhinga Forest. Under existing circumstances, however, other kinds, which prefer a soil of this description and are less exposed to injury by cattle, get the upper hand. The sál in the Bhinga Forest attains a good height.

The following measurements of average-sized trees were taken on the 6th February, north of the closed Ponsonbyganj block :—

No.	Girth.	Total height.
1	3 feet 3 inches	69 feet.
2	3 „ 4 „	79 „
3	4 „ 4 „	74 „
4	5 „ 4 „	82 „
5	6 „ 3 „	76 „
6	8 „ 6 „	106 „ 35 feet to first branch.
7	10 „	81 „

and near the Asneria closed block, on the 8th February :—

No.	Girth.	Height.
1	3 feet 10 inches	83 feet.
2	4 „ 7 „	87 „
3	5 „ 8 „	98 „
4	8 „ 5 „	101 „

* It is, perhaps, not unreasonable to connect the formation of the belts of high ground on which the Oudh sál forests are found with the action of the great rivers which enter this forest belt from the Nepál Himalaya. The Pilibhít, Púranpur, and Bhira Forests, which occupy the long belt of high ground south-west of the Sárda River, as well as that portion of the Trans-Sárda Forests which is on the high ground opposite, are deposits chiefly of sand brought down by the Sárda River, in ages long gone by, from the crystalline rocks of the inner hills. In this part of its course, the Sárda River now chiefly deposits sand, and the clay deposits of that river are not met with until we reach a point much further down its course. The high ground on which the greater part of the Motipur Forest stands probably owes its origin to the action of the Kauriála River in ages gone by. The Rápti, on the other hand, takes its rise in the outer ranges of the Himalaya; its flow is less rapid, and although during the rains the river chiefly deposits sand along its banks, yet it is not unreasonable to suppose that, at the time when the high ground was formed on which the Bhinga Forest stands, the deposits of the river in this part of its course chiefly consisted of clay and fine stiff loam.

Other trees.

39. The tree which thrives best in this forest is the tendu, and of this kind considerable masses of young growth and of poles and trees of all sizes are found. Asaina *(Terminalia tomentosa)*, which generally affects a stiff soil, provided it is sufficiently moist, is much less common than tendu, probably because the cattle eat young asaina greedily, while they do not touch the harder leaf of the tendu. The following is a list of the other chief trees and shrubs noticed in this forest besides sál, tendu, and asaina :—

Miliusa velutina	... Kariota.
Saccopetalum tomentosum	... Karri.
Ægle Marmelos	... Bél.
Schleichera trijuga	... Kusum.
Buchanania latifolia	... Perua.
Ougeinia dalbergioides	... Pánar.
Dalbergia lanceolaria	... Sundra.
Bauhinia racemosa	... Amlosa.
Terminalia bellerica	... Bahera.
Terminalia Chebula	... Harra.
Eugenia operculata	... Gurguri.
Casearia tomentosa	.. Bheri.
Nauclea cordifolia	... Tikui or Haldu.
Gardenia turgida	... Karhar.
Bassia latifolia	... Mohwa.
Holarrhena antidysenterica ...	... Dudhi.
Ulmus integrifolia	... Bissainda.
Mallotus phillippinensis	... Rohni.

Thorny scrub.

40. A remarkable feature in this forest is the large area covered with dense thorny scrub on the outskirts, particularly in the south-westerly portion. The chief kinds composing this scrub are the following :—

Zizyphus Œnoplia ...	...	...	...	Sitáina.
Zizyphus xylopyra ...	...	...	...	Makuia.
Randia dumetorum ...	...	...	...	Maini.
Carissa diffusa ...	...	...	...	Karaunda.

Protection.

41. With few exceptions, no fires have passed through the Bhinga Forest since 1873. This very satisfactory result has been accomplished by steady vigilance. At the same time it must be remembered that fire-protection has been greatly facilitated by the absence of all grass, which is eaten by the cattle as fast as it springs up. Three blocks have been enclosed and protected against cattle, *viz.*, first (since 1875), the *Kakardari* block, opposite the rest-house of the same name, measuring 22 acres ; second (since 1872), *Asneria*, opposite the village of the same name in the northern portion of the forest, area 5 acres ; third (since 1872), the *Ponsonbyganj* block, a triangular piece between three roads, area 1,440 acres. Two of these blocks are well stocked with grass. In the Asneria block cattle got in, and there is less grass than in the others.

Ponsonbyganj block.

42. In the Ponsonbyganj block all large sál trees were cut before it was enclosed, and the number of sál seedlings that have sprung up is very small indeed. I did not find any, but I am assured that there are some. Instead of sál, an immense amount of rohni has come up in dense thickets covering a large portion of the area. In places there is a young growth of dudhi, asaina, and tendu. The scarcity of sál seedlings in this block must no doubt chiefly

be ascribed to the absence of seed; for although sál seed is carried some distance by high winds, it does not generally travel very far. The soil under the grass, moreover, is hard and baked; but though under the thickets of rohni the soil is loose and soft, yet seedlings are scarce. To some extent the absence of seedlings may be ascribed to the scarcity of sál seed in the spring of 1880. There was, however, a good seed year in the spring of 1878, and there was a good crop in the spring of 1879, but the seed ripened early, before the regular rains set in. It should also be mentioned that this block was fired by shikáris in April 1875, and that the grass and much of the young growth which had sprung up were destroyed. In order to secure the protection from fire of this enclosed block, a strip of grass 100 feet wide is cut every year about February and March. The people who cut it are permitted, in lieu of receiving payment, to take half the grass, the other half being sold on account of Government. In dry years, when grass outside the forest is scarce, the grass in this block finds a ready sale; and I am inclined to suggest, by way of experiment, that in such years the whole of the grass in this block be cut and sold. Some damage, it is true, may be done to sál seedlings in cutting this grass, but some revenue will be realized, and, if a good seed year occurs, the cutting of the grass may facilitate the springing up of seedlings. I have also considered whether it would be advisable to cut down the brushwood of rohni, but am inclined to think it is useful in keeping the ground more loose, and thus facilitating the growing up of young sál, which, it must be remembered, bears a considerable amount of shade.

Sal seedlings in Asneria and Kakardari blocks.

43. In the Asneria block 133 sál seedlings were counted, which is at the rate of 27 seedlings per acre; while outside, going from the block to the main road, on a length of 4,356 feet and a breadth of 50 feet, only 15 seedlings were counted, which is at the rate of three seedlings per acre. This shows at a glance the beneficial effect of closing where, as in this case, there is no lack of seed-bearing trees. The seedlings would have been more numerous had the cattle not got into the Asneria block. In the Kakardari block it was not practicable to count seedlings in the whole of the block, but they were counted along the two principal pathways: total length 2,440 feet, with a width of 50 feet, the result being 118 seedlings on an area of 2·8 acres, or 42 seedlings per acre. All the seedlings in these two blocks, which were dug out and examined, had grown up since the blocks were first closed, but nevertheless they had not done so without check. Each plant was found to consist of a thick root, with numerous marks at the top of the shoots which had sprung up annually and which had successively been killed. The appearance of these plants was similar to that of plants which have grown up under the influence of annual fires. But in the present case the cause which cut back the annual shoot must be sought either in the drought of the hot season, or in the excess of water on the ground during the monsoon. This is a subject, the study of which is recommended to all young Forest Officers in Oudh.

Extension of closed blocks.

44. As regards the future treatment of the Bhinga Forest, the right thing to do doubtless is to enclose as large a portion as possible and to prevent the ingress of cattle; but the experience gained in the Ponsonbyganj closed block clearly shews that in the areas thus proposed to be closed all seed-bearing trees must be left standing. The most convenient arrangement will be to work gradually towards closing a continuous belt comprising the inner portion of the forest, leaving open for pasture about half the forest, which should as far as practicable be situated on the outer edge. Wherever possible such portions of the forest as are well stocked and have good soil should be included in the closed block. This may necessitate the closing here and there of areas situated near the edge, larger areas of inferior soil being excluded in other places. Thus I would strongly advocate the inclusion of the forest situated east of the Ponsonbyganj closed block. Nevertheless, many valuable pieces of forest, especially on the north-eastern edge, must remain unprotected, as it is not possible to close them; but this cannot be helped.

As already stated, the closing of this area should be gradual, and, as far as practicable, the expenses of fencing should be covered by the sale of the grass, which will generally spring up in abundance during the second season after fencing. The Ponsonbyganj block is on one side bounded by a deep ditch, but experience has shown that, though very effective when new, it is apt to silt up, and requires constant repairs, and the best plan will probably be to surround the closed block with a strong fence of thorns.

Revenue.

45. The revenue of the Bhinga Forest has been as follows :—

Items.	1877-78.			1878-79.			1879-80.		
	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Timber	21,000	8	0	6,568	5	6	7,568	8	0
Grazing	3,342	4	1	2,879	7	6	2,019	12	6
Mohwa	850	0	0	1,000	0	0	1,360	0	0
Miscellaneous	1,430	9	2	624	1	0	537	12	6
Total ...	26,623	5	3	11,071	14	0	11,986	1	0

Free permits.

46. In this, as in the other Oudh Forests, the practice is that persons who desire to remove thorns from the forests for fencing get a free permit from the Forest Guard. Thorns are used very extensively by the adjoining villages in order to fence their fields, and in many places along the south-western boundary I saw that a substantial and continuous thorn fence had been made along the outer boundary of the forest. The removal of thorns from the forest for this purpose should by all means be encouraged, and I would suggest that during three months—July, August, and September—the inhabitants of the neighbouring villages should be allowed to collect thorns without permit. Persons who take out firewood also obtain permission from the Forest Guard, but instead of a permit a mark is stamped with paint on their leg or arm. Permission to remove unreserved wood is also granted by the Forest Guard.

Permits on payment.

47. So far regarding free permits. Permits on payment are granted in the following manner.

In the case of sál and other reserved woods, the permits for dry timber are granted by the Ranger, while the Divisional Officer reserves to himself or to his Assistant the right of giving permission for green sál or other reserved timber. Here, as in the other Oudh Forests, the grazing dues are paid according to two sets of rates—a lower rate for the villages within three miles from the forest, *viz.*, 2 annas a cow or bullock and 6 annas a buffalo ; while the villages beyond that limit pay 3 annas for a cow or bullock and 9 annas for a buffalo. Permits are granted by an official specially appointed, the grazing Mohurrir. This official is always on the move, counting the cattle in the villages outside. The average annual number of cattle grazed in this forest during the last three years is reported to have been as follows :—

Cows and bullocks	12,048
Buffaloes	1,901
Sheep and goats	1,403

Herdsmen are not permitted to lop trees, or even to take axes into the forest ; and upon the whole I found this rule well observed. I only came across one instance of extensive lopping, and this was in the southernmost part of the forest, near the village of Gokal Sing. Here almost all the large trees had been lopped. This practice must have continued for several months, and it is not

satisfactory that it was permitted to continue so long. I was informed that the offenders had been punished. A glance at that part of the forest where loppings have taken place shews that the herdsmen who did it, although for the moment they got a supply of leaves for their cattle, in reality injured the pasture in the forest by diminishing the cover overhead. Wherever there are no trees, the thicket of thorns covers the ground and becomes quite impassable, thus diminishing the area accessible to cattle.

Revenue how to be increased.

48. Every effort should be made to increase the revenue from this forest. A considerable quantity of dry sál is brought out annually, in the shape of round logs and scantlings (thunis and thamras) adzed out of hollow logs. The logs are paid for according to quality, at rates from 2 to 12 annas a cubic foot; while the scantlings are sold at the rate of 8 annas to one rupee each, according to size. Green trees have of late years been only given for dug-outs. These are hollowed out in the forest, and paid for at the rate of Rs. 20 a boat.

The export of dry timber is greatly stimulated by the excellent system of roads and wells by which these forests have been made accessible. I examined several depôts on the edge of the forest, where the dry logs and boats are collected to be finally stamped and paid for. Yet there is a great quantity of dry and half-dead timber which might be utilized.

Cuttings proposed.

49. In order to increase the revenue of this forest, it will be necessary to commence the cutting of green sál. The demand for timber east of the Rápti is considerable. It is expected that all trees selected for cutting can be sold standing, and the local officers entertain the hope, which seems rather sanguine, that they will realize a net revenue of Rs. 35 per tree on an average. These cuttings, however, must be made with great caution, and no green sál trees should be cut in those portions of the forest which it is intended to include within the closed block. Practically, then, the cutting of green sál will be limited to the outskirts of the forest, which will be used chiefly as grazing grounds.

Growing stock of different classes.

50. On several lines which were cut in the years 1869, 1870, and 1871 in these forests, to a width of 50 and in one case of 100 feet, the trees recorded in the following statement were found growing on an aggregate area of 219·5 acres :—

Valuation surveys, Bhinga Forest (Kakardari and Bhinga beats).

Area Surveyed.	Acres.	Sal.				Tendu, Asaina, and other reserved trees.				Miscellaneous.				Remarks.
		Over 6 feet in girth.	Over 4½ feet in girth.	Over 3 feet in girth.	Over 1½ feet in girth.	Over 6 feet in girth.	Over 4½ feet in girth.	Over 3 feet in girth.	Over 1½ feet in girth.	Over 6 feet in girth.	Over 4½ feet in girth.	Over 3 feet in girth.	Over 1½ feet in girth.	
1. Survey 1869: cross line Bhartha to Shahpur—100 feet wide	37·09	132	86	80	35	11	34	250	440	11	45	686	1,661	Oudh Forest Report for 1869-70, Appendix No. VI.
2. Survey 1870: line up middle and lines about Ponsoubyganj—50 feet wide	143·51	420	235	330	451	42	86	534	1,909	45	118	793	3,435	Oudh Forest Report for 1870-71, Appendix No. III.
3. Survey 1871: line from Ranipur to ray line No. 1, Section 7—50 feet wide	13·77	53	32	9	12	7	2	40	144	5	2	18	65	Oudh Forest Report for 1871-72, Appendix No. IV.
Cross line (1871)—50 feet wide. ..	25·13	121	64	6	25	19	12	158	654	3	7	38	169	Oudh Forest Report for 1871-72, Appendix No. IV.
Total ...	219·50	726	417	425	523	79	134	982	3,147	64	172	1,535	5,330	

The results per acre are as follows :—

	Sál.	Other reserved trees.	Miscellaneous.	Total.
First class, in girth 6 feet and upwards	3·30	0·36	0·29	3·95
Second „ „ 4 „ 6 inches to 6 feet	1·89	0·61	0·78	3·28
Third „ „ 3 „ to 4 feet 6 inches	1·93	4·47	6·99	13·39
Fourth „ „ 1 foot 6 inches to 3 feet	2·38	14·33	24·28	40·99
Total ...	9·50	19·77	32·34	61·61

A comparison of these figures with the results of the valuation surveys made between 1867 and 1871 in the Trans-Sárda Forests, in the Kheri District, as recorded in paragraph 20 of the Report containing suggestions regarding the working of those forests, of August 1880, shows a marked difference, in so far that in the Bhinga Forest the number of sál trees of the three smaller classes is insignificant. The figures placed side by side with those of the Kheri Forests are as follows :—

	Kheri.	Bhinga
Sál above 6 feet in girth	3·64	3·30
„ between 18 inches and 6 feet in girth ...	46·87	6·20
	50·51	9·50

When the closed block at Ponsonbyganj (1,440 acres) was cut over in 1872, about 2,500 full-sized sál trees of inferior quality, including 115 which were made into boats and a few second class trees, were cut, which amounts to 1·7 trees per acre. These are the only data which we at present have regarding the quantity of timber standing in the Bhinga Forest, but for the present purpose these data are sufficient.

The cuttings of Sal outside the closed block must be spread over forty years.

51. Broadly speaking, the case stands thus :—we propose to close about 30 square miles, and in this area no sál should be cut until the ground has become fairly stocked with young growth. Having regard to the indifferent reproduction in the small blocks hitherto closed, we are not justified in expecting that this will be effected in less than forty years. Hence the cutting of green sál trees outside the closed block must be spread over the next forty years.

Quantity which may be cut annually.

52. The area outside the closed block in which it is proposed to make these cuttings may be estimated at 20,000 acres, and about one-half of this area, along the north-eastern edge, may be assumed to contain two first class sál trees per acre; whereas the other half, along the south-western edge, is not likely to contain more than one tree per acre. This number of first class trees in the outer part of the forest must be regarded merely as a rough guess, which is put forth in the present case more by way of illustration of what is meant than as an estimate of the growing stock standing on the ground.

Of the 30,000 trees assumed to stand on the area which it is proposed not to close, a small proportion only can be expected to be sound. Of the 2,500 trees cut in 1872, only about 6 per cent. were sound. The sole object of the cuttings here proposed is to produce revenue. The removal of the trees will not improve the prospects of reproduction, nor will it improve the pasture in the forest. On the contrary, if the trees are removed, the soil will dry up and

will produce less grass and more thorns. Under these circumstances, it is not advisable to cut more than a portion of these trees. If we limit the annual cuttings outside the blocks proposed to be closed to 300 trees, an aggregate of 12,000 trees will have been cut during the next forty years; and considering that there is a number (though limited) of smaller trees on the ground which will attain the dimensions of first class trees during this period, it may be hoped that the cuttings here proposed will not have the effect of materially injuring the pasture in this part of the forest. These 300 trees proposed to be cut annually cannot of course be all perfectly sound; but revenue being the chief object, the best trees only should be selected for cutting.

Arrangement of cuttings.

53. The question now arises, whether these 300 trees should be cut in regular order, beginning at one end of the forest and taking in hand one block a year? If it were possible to divide the forest into compartments, containing each about the same quantity of mature timber, such regular cuttings would be the proper thing; but, under the circumstances of the case, no material advantage would be gained by insisting on a regular order of cuttings, and it is better to make the greatest amount of revenue which these operations are capable of yielding by permitting the purchasers to select the trees to be cut in the most favourable localities. As a matter of course, the present practice must be maintained, under which the selection of all green sál trees requires the approval of the Divisional Officer or his Assistant. The greatest care will have to be taken in determining the boundaries of the area proposed to be included within the closed block, so that no green sál trees may be cut within the limit of that area.

The yield of 300 sál trees a year will, as a matter of course, be supplemented by dry timber and trees half-dead, which should be cut as hitherto.

Cutting of other kinds.

54. As regards the cutting of other trees, not sál, I am inclined to advocate that this be limited to the areas proposed to be closed. On the outskirts proposed chiefly to be utilized as pasture lands, it will probably be better to spare such trees. Limited quantities of tendu, asaina, and assid might be cut within the closed area, if there is sufficient demand for these woods to ensure remunerative prices.

Lines, rest-houses, and wells.

55. This forest is traversed by an excellent system of lines, aggregating 70 miles, nearly all of which are well used by cart traffic. A large number of additional lines will have to be cut in order to define the interior block proposed to be closed. There are at present two rest-houses—one at Ponsonbyganj, the other at Kakardari. The former, I advocate, should be abandoned, and a good two-storied forest house, on the Belraien (Kheri) pattern, built instead on the outer western edge of the forest, on rising ground in the vicinity of the village of Chahlua. Ponsonbyganj is too confined, and a station in the open country on the edge of the forest, with free circulation of air, will be found to be more healthy than a place in the heart of the forest. Numerous excellent wells have been made in the Bhinga Forest.

Establishment.

56. The Bhinga Forest is at present divided into two beats, each in charge of a Forest Guard assisted by an under Forest Guard; and, as already explained, these men have, in addition to their protective duties, the granting of permits for thorns, firewood, and woods of unreserved kinds, free to the people living within three miles of the forest, and on payment to those living beyond this limit. The result of this arrangement is that the head Forest Guards are too much tied down to their head-quarters, and hence protection is not as it ought to be. Yet arrangements must be made for the people to get permits without loss of time, and it may be desirable, as an experiment, to carry

out a suggestion made by the Conservator to employ a separate Forester for this purpose. If this is done, an arrangement should be made to keep the protective officers informed of all permits issued. I am inclined to think that it would be well to adopt the practice of requiring that each of the numerous cleared lines be gone over by the protective officer at least once a month, and to establish a rule that an abstract report of his visits be submitted to the Divisional Officer once a month.

Periodical measurement of standing trees.

57. On the 6th February I examined the quarter-acre plot demarcated in this forest for the periodical measurement of standing sál trees. The total number of trees marked and measured on this plot is 21. The plot is surrounded by a ditch and will be included within the block proposed to be closed. With regard to this plot, and those demarcated for the same purpose in other parts of the Oudh Forests, I have the following suggestions to offer. *First*, the plots should be made larger, and their number should be less. In the case of very small areas, the existence or absence of any large trees standing outside and near the edge must necessarily affect the rate of growth of the trees measured. One plot of two acres in each division is sufficient, and plots of this size may be expected to give reliable results. If the measurement of all trees on two acres gives too much work, we must be satisfied with one-acre plots, but there should not be more than one in each division. No trees should, as a rule, be cut within a belt about 100 feet wide all round the plot. *Second*, the plots should, as much as possible, be selected in a part of the forest where the cover is complete and where there is no grass on the ground. Suppressed and decaying trees, which are not likely to form part of the final crop, should be thinned out before the measurements commence. *Third*, all trees left standing should be marked and measured, whether sál or not; and the measurements should be made at a point where the stem is not slanting, but perfectly straight, round, and regularly shaped, whether that point is at five feet from the ground or at a greater or less height.

The seasons selected by Captain Wood for measurement, about the 1st June, 1st December, and 1st March, are suitable; but, eventually, I think that it will suffice to take measurements twice a year, in December and May.

Charda and Chakia Forests.

58. The Charda and Chakia Forests are situated near the Nepál frontier, on the high ground which intervenes between the Rápti and Chhota Sarju Rivers and which extends south as far as Ikauna and the head-waters of the Kohani River.

Charda: area, soil, and growing stock.

59. The Charda Forest is five miles long from north to south, and on an average two miles broad; hence its approximate area is 10 square miles. It is traversed by the Rátia Nala and the ground in the northern portion is undulating. The surface soil varies extremely; in some places it is light and sandy, and in others it is a hard and stiff loam. The greater part of the forest is stocked with a dense mass of poles of sál, with a sprinkling of old trees of asaina, tikui, bahera, and, near the Nepál border, a small proportion of dhaura. With the exception of a few old crooked trees, all mature sál was cut out before the forest was taken over by the Forest Department. On low ground there is a number of large trees of sirsa (*Albizzia procera*). On the outskirts, particularly on the south side, there is a large proportion of thorny scrub consisting of the same species as in the Bhinga Forest. Under the sál poles the ground is often covered with a dense underwood of kasrauta *(Flemingia strobilifera)*, which is extensively used for basket work.

Growth of Sal.

60. The most remarkable feature in the forest is the great difference in the growth of sál in the different portions. In some places, particularly in

the north-east corner, the condition of sál is all that could be desired, and the following poles, which were measured near the Sátia line, may be taken as average specimens :—

	Girth.	Height.
No. 1	... 2 feet 5 inches	... 57 feet.
„ 2	... 2 „ 11 „	... 61 „

In other places, again, there is a large number of poles with dry tops, and also of mature trees which have died. I noticed this particularly south of Abdullaganj, and over a large area near the north-western edge of the forest, where the soil was poor and dry. No satisfactory explanation can be given of this remarkable diversity in the growth of sál. In paragraph 48 of the Forest Report for 1878-79, Captain Wood states that "In Charda numbers of saplings have died, owing, I fancy, to the drought and to the poverty of the soil." The largest number of dead poles and trees was noticed on poor soil near the western edge, where the forest was imperfectly stocked. It is not impossible that the dry westerly winds of the hot weather may have an injurious effect on isolated sál trees. The phenomenon has only been noticed during the last two years, which were seasons of exceptional drought. It should, however, be mentioned that scattered dead sál poles and trees are likewise found in the north-east part of the forest, surrounded by vigorously growing young plants of sál.

Protection.

61. The Charda Forest has not been burnt since 1872. Except on the north, where it adjoins the forests in Nepál, it is surrounded by cultivation, which facilitates protection ; but a special establishment for fire-protection is entertained during from three to five months, costing about Rs. 100 a month. The progress made by the sál poles since my visit in 1875 has been very remarkable in this forest; they were then on an average from 10 to 15 feet high, and now they are between 30 and 50 feet high.

Lines ; rest-houses ; proposals for closing the forest.

62. The Charda Forest is traversed by an excellent system of 15-foot lines, most of which are used for cart traffic. A rest-house of the old pattern is in the centre of the forest at Abdullaganj. When the time comes for erecting a more permanent building, another site should be selected, not inside the forest, but on the outskirts, which will doubtless be found more healthy than any site in the forest. As in the other Oudh Forests, so in Charda, the cattle of the neighbouring villages graze in the forest on payment of the lower or privileged rates ; but Government has not undertaken the obligation to keep the whole forest open for this purpose : hence the Conservator proposes to close against pasture a block of triangular shape in the northern portion, measuring about two square miles. This block includes tracts in which large numbers of young and old trees have died as above described. Experience must show whether the closing of the forest, and the improvement of the vegetation which will result therefrom, will remedy this evil.

Revenue.

63. The revenue of the Charda Forest has been as follows :—

Items.	1877-78.			1878-79.			1879-80.		
	Rs.	As.	P.	Rs.	As.	P.	Rs.	As.	P.
Timber	278	4	3	388	8	10	400	0	0
Grazing	1,145	9	3	779	0	0	461	3	3
Mohwa	45	0	0	...			40	0	0
Miscellaneous	157	14	8	71	2	5	49	6	6
Total ...	1,626	12	2	1,238	11	3	950	9	9

Chakia: area, soil, and growing stock.

64. The Chakia Forest forms an irregular belt along the Nepál boundary, about 9 miles long, and the area is given at about 20 square miles. The soil is generally a light sandy loam at the surface, overlying strata of grey micaceous sand. At the Kharecha rest-house a well was lately dug 40 feet deep, of which the upper 35 feet consisted of a light sandy loam, while the lower 5 feet consisted of grey sand, composed of grains of quartz, felspar, and black hornblende, with a great deal of mica. The forest is traversed by the Mánd River, east of which is mixed forest with patches of good sál poles, while west of the river it is well stocked with dense masses of tall and straight poles of sál.

The following average specimens of sál were measured:—

	Girth.	Height.
No. 1 ...	... 2 feet ...	... 55 feet
„ 2 ...	... 2 „ 4½ inches...	... 66 „
„ 3 ...	... 2 „ 8 „ ...	... 63 „
„ 4 ...	... 2 „ 9 „ ...	... 68½ „
„ 5 ...	... 2 „ 11 „ ...	... 70 „
„ 6 ...	... 3 „ ...	... 68 „
„ 7 ...	... 3 „ ...	... 76 „
Asaina	... 4 „ 6 inches ...	... 91 „

As regards other trees, it may be noticed that karri *(Saccopetalum tomentosum)* attains a considerable size. A specimen 3 feet 6½ inches in girth was measured.

Protection: rest-house.

65. Up to date fires have gone through the Chakia Forest every year, but, as the grass is very light, they do not do much damage. The forest is traversed by a system of roads, which, however, is not completed; and a rest-house is being built in the centre, called Kharecha.

Revenue.

66. The revenue has been as follows:—

Items.	1877-78.			1878-79.			1879-80.		
	Rs.	As.	P.	Rs.	As.	P.	Rs.	As.	P.
Timber	1,091	6	3	1,729	4	1	1,698	7	11
Grazing	674	7	0	662	14	3	650	0	0
Mohwa	45	0	0	20	2	6	40	0	0
Miscellaneous	167	4	8	399	7	2	16	0	0
Total ...	1,978	1	11	2,811	12	0	2,404	7	11

Motipur Forest.

67. The area of the Motipur Forest is estimated at 127 square miles, and the forest is divided into ten blocks. Blocks I and II (North and South Bharthapur) occupy the greater part of the land between the Kauriála and Girwa Rivers; it is all low ground, with light sandy soil, stocked with grass and scattered khair and sissoo trees. Block VI (Nishángára) and Block VIII (Motipur) occupy the high ground between the Kauriála and Chhota Sarju Rivers. Blocks III, IV, V, VII, and IX comprise stretches of low land, stocked chiefly with grass, and with scattered khair and sissoo trees in the vicinity of the Girwa and Kauriála Rivers. Block X (Babayi), situated on low ground south of Motipur, consists chiefly of dhák and scrub. The most valuable portion is the stretch of high ground which extends from Anba Bishanpur to Ainchua village—a length of 24 miles, with an average width of 2½ miles. The northern and western edges of this high land are broken by ravines, and have generally poor and light soil; and on the east it is bounded partly by the Nepál boundary line, partly by the Chhota Sarju and by the land of several villages situated on the banks of that river. On the western boundary, also, there are stretches of low land, not stocked with sál, which are chiefly used as grazing grounds. The sál forest may be estimated to cover an area of 60 square miles, while the forest on low ground, which is chiefly used for pasture, may be estimated at 67 square miles.

Lines and rest-houses.

68. The forest on the high ground, or damár, is traversed by a system of roads and cleared lines, of which those running across the breadth of the forest, from Nepál to the villages between the forest and the Kauriála River, are much used for cart traffic. There are also some lines through the Bharthapur block, and one from Kataniaghat to Sujauli, which runs through low-lying forest south of the Girwa River. There is a two-storied rest-house at Nishángára, and two smaller houses at Sujauli, on the bank of the Kauriála River, and at Motipur.

Grass lands with Khair and Sissoo.

69. The forests on low ground have yielded revenue chiefly from the following sources:—

(1.) Grazing.

(2.) Thatching grass sold to villagers beyond three miles from the forest.

(3.) Sissoo wood sold to the Ordnance Department.

(4.) Dues paid by the manufacturers of katha or catechu.

During the last ten years the Ordnance Department has purchased about 20,000 sissoo trees, for which it has paid upwards of Rs. 3,00,000, at the rate of 8 annas per cubic foot. It must, however, be borne in mind that the Ordnance Department picked out the very best trees, and that they left the inferior trees standing. These sissoo trees were chiefly cut in the north-western corner of the Bharthapur block, near the Kauriála River; in the Chahlua block, east of the Girwa River; and in the Dharmánpur block, south-west of the village of the same name. Licenses to manufacture catechu were granted for the first time in 1879-80, payment being levied at the rate of 8 annas for each (earthen) pot, which realized an aggregate revenue of Rs. 1,700.

The operations of the Ordnance Department in this division have been completed, and they have transferred their machinery to the east bank of the Sárda River, in pargana Púranpur, Pilibhít District, on the border of Nepál. Although the best trees have been cut out, there is still a large quantity of sissoo timber standing on the ground, and it is desirable to cut a certain quantity annually, which may either be sold standing to purchasers or sent down to Bahramghat.

Limit of Khair and Sissoo trees to be cut annually.

70. It is a matter for serious consideration how much sissoo timber may be cut a year, and how many licenses for the manufacture of catechu may be granted. Regarding the growing stock of khair and sissoo on this area, no definite information is available. The area which contains khair and sissoo trees may be estimated at 50 square miles. Assuming that this area bears on an average two mature khair trees per acre, there would be upwards of 64,000 khair trees on the ground. Sissoo is less abundant, and of the 67 square miles of low ground certainly not more than 30 will, on examination, be found to be stocked with sissoo. Assuming that one mature sissoo tree is found on two acres, there would only be 9,600 mature sissoo trees on this area. These figures are a mere assumption, and are not based upon any definite data (which are not available). The sole object in mentioning them is to make it clear that the supply of neither khair or sissoo is inexhaustible in this area, and that some limit must be fixed for cuttings. Obviously, there are two modes of fixing such a limit—either the whole area of these forests on low ground should be divided into a certain number of compartments, one compartment being assigned to the operations of each year; or a maximum number of sissoo and khair trees should be fixed to be felled annually. The former plan is, I fear, impracticable at present. The manufacturers of catechu have the forests in the whole Nepál Tarái to choose from, and we cannot expect them to confine these operations in the British forests to the compartment which may be assigned to them every year. In the same way with sissoo, we must at present consult the convenience of purchasers.

Natural reproduction of Khair and Sissoo.

71. Under existing circumstances, the reproduction of these two trees in the area in question is almost *nil*. The whole ground is traversed by jungle-fires during the hot season, which, owing to the high grass in most places, are exceedingly fierce and consume all young growth which might otherwise spring up. A large portion of the khair and sissoo growing on these low-lands is probably water-sown, the seed having been brought down and deposited on fresh-formed banks. As long as this state of things—that is, the absence of reproduction of these two trees—continues, all data are wanting to determine the proportion of the area which may annually be opened for cutting, or the maximum number of trees to be cut.

Establishment of closed blocks.

72. The most important measure, therefore, to take in this respect will be to protect certain suitable areas against cattle and fire, in the hope that this will have the effect of encouraging the growth of young khair and sissoo. As a commencement, I propose that the forest in the north-west corner, on the Nepál boundary, which intervenes between the Kauriála River and the Angarghat Nala, be closed against cattle and fire, and that, if this measure proves successful in increasing natural reproduction, other blocks similarly favourable be closed and strictly protected. At the present time several proposals are under consideration for exchanging portions of the low-lying ground against other plots, so that no further plans regarding the areas which may be closed can be made. As soon, however, as proposals can be framed for plots to be closed, it should be arranged that no trees should be felled in these areas. The circumstances here are analogous to what they are in the Bhinga Forest; hence the proposals submitted are of a similar nature.

Cuttings to be made only outside the closed blocks.

73. No trees should be cut in the blocks closed and proposed to be closed, but outside these a certain revenue should be made annually by the cutting of sissoo timber, and by granting licenses for the manufacture of catechu. As regards sissoo nothing can be done but, as a temporary measure, to agree upon an arbitrary limit, which may be fixed at 200 trees a year. As regards catechu, before any limit can be fixed, data must first be collected to show how many trees are required to keep a certain number of pots at work during the season. This should be ascertained by carefully watching the operations of the khairahas, or catechu boilers, and until these data have been collected nothing can be done except to be cautious in granting licenses.

Experimental plantations of Khair and Sissoo.

74. In connection with this subject, it should be mentioned that an experimental plantation of khair and sissoo has been established on the low ground immediately below the rest-house of Nishángára. The seeds were sown in nurseries in March and April 1880, and the plants were transplanted about the 15th June of the same year, when they were about two feet high. They have been planted 15 feet apart either way, and the grass has been cleared along lines 15 feet apart. Of khair a large proportion has succeeded. Of sissoo many of the transplants have died. The difficulty in these sissoo plantations in the forests is that the place is too unhealthy during the rains. A number of coolies employed on this work died in June 1880, and transplants made between November and May do not succeed unless watered. Experiments have been made to facilitate the transplanting, by sowing the seed in pots made in two longitudinal pieces; but even with these the plants, except in very moist ground, only succeed if watered. Sowing *in situ* has not succeeded, because it is not practicable to provide for the weeding during the rains. The cultivation of khair and sissoo in the Oudh Forests is still a matter of experiment, which as yet has given no definite results. Whatever new experiments may be made, I strongly advocate that the sowing or planting be made in continuous lines close together within the lines, the expense being diminished by having the lines 30 feet apart. If the ground

in these lines could be so dug up as to prevent the growth of grass and weeds during the first year, thick sowing *in situ* continuously in the lines may be found to succeed. An experiment should be made in running trenches along the lines, and sowing the seed on the soil thrown up alongside the trenches.

Forest on high ground.

75. Turning now to the forest on the damár, or high ground, the first thing that should be noticed is that the soil of the sál forest north of the village of Motipur is, upon the whole, far superior to the soil in the Bhinga or Charda Forest. Broadly speaking, it may be said that along the Nepál boundary line, from the Girwa to the Chhota Sarju River, there is a belt, varying in width, in which the surface soil is a stiff loam, and on this belt asaina preponderates; but that further south, on both sides of the main longitudinal line, the soil is a light sandy loam, with a great deal of vegetable mould in all depressions, and here sál is the dominant tree.

Growth of Sal excellent.

76. This part of the forest is stocked throughout with an excellent growth of sál, where the trees in many places stand so thick that there is no underwood on the ground. The following may be quoted as average-sized trees:—

No.	Girth.	Height.
1	... 2 feet 9 inches	... ... 82 feet.
2	... 2 „ 11 „	... ... 77 „
3	... 3 „	... ... 77 „
4	... 3 „ 1 „	... ... 77 „
5	... 3 „ 3 „	... ... 98 „
6	... 3 „ 8 „	... ... 77 „
7	... 3 „ 8 „	... ... 89 „
8	... 3 „ 11 „	... ... 96 „
9	... 3 „ 11 „	... ... 99 „
10	... 6 „ 2 „	... ... 108 „ (66 ft. to the first branch).
Asaina	... 6 „ 11 „	... ... 101 „

If these figures are compared with those of the Bhinga Forest, they show at a glance the great superiority of the sál in Motipur.

Two different classes of Sal forest.

77. Speaking broadly, it may be said that in this part of the forest a difference may be noted. South of the Motipur line, where the timber was nearer the market and was therefore cut at an earlier date, there are large and continuous belts completely stocked with poles, mostly from 2 feet to 3 feet 6 inches in girth. North of that line, in the Nishángára block, the trees are larger and scattered, the ground being covered with saplings and here and there with groups of younger poles. In this portion trees of other kinds are more numerous than in the forests south of the Motipur line. The last mentioned pole forests are almost pure sál, and the trees of other kinds are not numerous.

Future treatment of the pole forests.

78. It must be understood that this magnificent forest of poles and young trees varies considerably in the age and size of the trees, and that they will not all attain maturity at the same time. Nor would it be of any practical value at present to speculate upon the mode of cutting to be followed in this forest after the trees have attained maturity; but it may not be out of place here to mention that the study of the young growth which has sprung up on the Nepál boundary line throws some light upon this question, and is likely to be exceedingly useful when the time comes for determining the system of cutting to be followed in this forest. I examined a consider-

able portion of the Nepál boundary line, between the Chhota Sarju and the Girwa Rivers: the most instructive portion is between the Tárá Tál well and the Rori Nala. Here the line was completely cleared in 1873 to a width of 100 feet. On both sides there is high forest of sál and asaina, and in most places the line has become stocked with a dense young forest of coppice-shoots of these two kinds, which were on an average 15 to 20 feet high, with individual saplings rising to 35 feet. It must not, however, be supposed that this young forest is uniformly good throughout the entire length of the line. There are stretches of poor soil where scarcely any young growth has come up, and the same inequality may be noticed on other sections of this boundary line, or on other lines which have been cleared to the same width. Where, however, the soil is favourable, the young growth is complete; and a similar result was noticed along a portion of the Nepál boundary line, on the northern edge of the Charda Forest. The good growth in these places must, in my opinion, be ascribed chiefly to the circumstance that the high forest on both sides of a narrow cleared line affords partial shade and keeps the ground moist. Analogous to this case is the excellent success which has attended the planting up of narrow belts completely cleared of trees and bamboos in the Tharawaddy Forests in Burma. The young growth on the boundary line here mentioned consists of numerous other trees besides sál and asaina. Some of these, such as aonla *(Phyllanthus Emblica)* and pata (*Kydia calycina*), overtop the sál and asaina at present; but the further study of this young forest will doubtless show that the kinds named, and others which do not attain any large size, will gradually be suppressed and that the final forest will consist of sál and asaina, with a small mixture of asidha (*Lagerstrœmia parviflora*), bahera, pardah (*Stereospermum suaveolens*), kumbhi (*Careya arborea*), and a few other trees which attain a large size. It is not impossible that, when the present forest of large poles in Motipur attains maturity, some such system of clearances in narrow belts will be adopted in order to secure complete reproduction.

The boundary line north of the Charda Forest, which is remarkably well stocked with young sál, runs east and west, while that section of the Motipur boundary here described runs north and south. These two instances would seem to show that the direction of the cleared lines is of no great importance as regards reproduction of the forest, but this is a matter which requires further investigation. The careful study of the gradual changes which will take place on this and similar cleared lines is recommended to the attention of all Forest Officers in Oudh.

Closed blocks.

79. An area of 20 square miles, extending from the Jalia-Sálarpur line to the Chapharia-Rámpurwa line, a length of 8 miles with a width of two to three miles, has been closed against cattle and fires since 1878, and in this area the young growth has become exceedingly thick; but it must be remembered that along the north-eastern edge of this belt, where the soil is stiffer, the saplings and thickets of asaina have the upper hand. This closed area it is proposed to increase by adding to it a considerable portion of the forest between it and the edge of the high ground, so as to bring up the total area to 32 square miles. The forest outside the closed area is grazed over and is overrun by fires almost every year. There is, however, this difference between Motipur and most of the other sál forests in the Oudh Circle, that in Motipur the sál forest consists of a continuous belt of high ground, with no stretches of low ground stocked with grass. The continuity of the sál forest is only interrupted here and there by stretches of more open forest, not sál, formerly occupied by villages; but there are no extensive grass lands as in the Khairigarh and other Oudh Forests. Under the trees also there is much less grass than in Khairigarh and a much denser young growth. However, in a large portion of the Motipur Forest the fires are only partial and do very little damage, and fire-protection is much easier than in the other sál forests. It follows that, where there is marketable timber, cuttings may be made much more freely in Motipur than in the other forests.

Cutting of green Sal.

80. A limited number of green sál trees are cut annually for boats, and a few hundred are sold standing for timber (200 in 1879-80 and 250 in 1880-81). These cuttings may be continued, and, owing to the absence of grass, it will be possible to cut both in the protected block and outside its limits. No plan of cuttings is called for at present, and it will suffice to say that only 300 trees annually may be sold standing to purchasers, provided they are selected by the Divisional Officer or his Assistant. As already stated, the compact pole forests had better be left alone until they attain maturity. These cuttings may be expected to yield a revenue of Rs. 9,000 a year. Hollow trees for boats may be cut in addition. It will be well to be content with these cuttings on a moderate scale during, say, the next five years, after which period it is probable that the cuttings in this forest can be increased very considerably.

Cutting of Asaina proposed.

81. It has already been mentioned that in a large portion of this forest, *viz.*, that which adjoins the Nepál boundary line, asaina has the upper hand over sál. The larger trees are more numerous, and the ground is covered with a preponderating young growth of asaina. One of the most important works of improvement in this part of the forest will be to cut out as many asaina trees as possible, in order to give a better chance to sál. An attempt should be made to induce purchasers to come up and cut asaina trees, by fixing a very low rate, say one anna a cubic foot, or even less. In this case the object is not so much to produce revenue as to clear the way for sál. Permission might also be given to remove poles of asaina without payment.

Cutting of trees of other kinds.

82. There is a considerable number of large trees of tikui and bahera in this forest, and though there is no risk of these kinds getting the upper hand, as is the case with asaina, still it would be well to open a market for them, if possible. They might be sold (standing) at low rates without limit.

It was very satisfactory to notice the large number of kusum trees of all sizes in this forest. These trees, when mature, will have a very great value, as the kusum in the other forests in the vicinity has been cut out. Not being gregarious, the kusum in no way interferes with the sál; and the stock of these trees should not be touched at present, except that a few old trees may, from time to time, be sold.

Bamboos.

83. South of the gauri or cattle station of Murtiha is a considerable extent of bamboo forest, about 500 acres in area. The bamboo is of the thorny kind (*Bambusa arundinacea*). Some of the clumps seeded last year, and the remainder have seeded in 1881. After seeding, all stems will die down, and no revenue can for some time be derived from this source. At present, this part of the forest is burnt annually, and is overrun by cattle. If this continues, there is no chance of any young growth of the bamboo coming up. In order to prevent the bamboo and this source of revenue being destroyed, it will be necessary to include the area stocked by the old bamboos in the closed block. This area should also be surrounded by a fence of thorns. These bamboos have, I was told, hitherto yielded a revenue of about Rs. 100 a year. It will probably not be necessary to fence in the other portions of the block proposed to be closed. On the south-west edge of the high ground there are some clumps of the common Indian bamboo (*Dendrocalamus strictus*). I was told that they had all seeded, and as far as possible they ought to be included in the closed block, to prevent the extermination of the bamboo. The outer range of hills in Nepál is said to be well stocked with the common Indian bamboo, but it is very remarkable that there is no export into Oudh of bamboos from Nepál, either by the Kauriála or Chhota Sarju Rivers. Nevertheless, if the supply of bamboos in the Motipur Forests could be increased, they would doubtless find a ready market.

Revenue.

84. The revenue of the Motipur Forest during the last three years has been as follows:—

Items.	1877-78.			1878-79.			1879-80.		
	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
Timber	40,527	7	7	16,826	0	10	11,722	0	1
Grazing	9,925	15	3	7,359	3	6	7,827	1	9
Mohwa	109	0	0	15	5	4	135	0	0
Miscellaneous	1,567	8	5	1,088	0	9	2,393	0	2
Total ...	52,129	10	3	25,288	10	5	22,077	2	0

It will be noticed that there has been a great falling off in the revenue from timber, and this is due, as explained above, to the diminished sales of sissoo trees to the Ordnance Department. Among the other items bankas or bhaib may be mentioned, which is common on the north-western edge of the high ground.

Measurement of Sal trees.

85. In this forest I examined the two quarter-acre plots demarcated for the periodical measurement of sál trees. Begging reference to the remarks made in regard to the Bhinga Forest, I would here also suggest that, instead of these two small plots, one plot of at least one acre, and if possible of two acres, be selected and demarcated in the midst of a dense and completely stocked forest of sál poles, if possible without any underwood.

The Motipur Forest is divided into three beats, each in charge of two Forest Guards, namely, the Bharthapur beat (Blocks I and II), the Nishángára beat (Blocks III to VII), and the Motipur beat (Blocks VIII to X). There is also a grazing Mohurrir on the temporary establishment, who has special charge of the grazing revenue.

Expenditure in the Bahraich Division.

86. The expenditure of the forests in the Bahraich Division, which includes, besides Bhinga, Charda, Chakia, and Motipur, also the Sohelwa Forest, has been as follows during the last three years:—

	1877-78.			1878-79.			1879-80.			Total.		
	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
A.—(1) Collection of revenue	4,806	15	0	4,643	8	1	2,333	13	3	11,784	4	4
(2) Communications and buildings ...	7,622	1	10	13,307	4	6	7,055	6	4	27,984	12	8
(3) Demarcation and improvement ...	3,754	2	2	2,888	9	1	3,550	4	6	10,192	15	9
(4) Other items	2,620	6	8	1,392	8	5	3,902	6	7	7,915	5	8
B.—Regular establishment	10,341	4	6	12,427	11	7	11,992	2	0	34,761	2	1
Total ...	29,144	14	2	34,659	9	8	28,834	0	8	92,638	8	6

In 1878-79 more lines were cut than usual; the Nishángára forest-house was built, and materials for the other forest-houses were collected: hence the larger

outlay on communications and buildings. It will be observed that during the three years noted Rs. 38,000, or considerably more than one-third of the total outlay, was for communications and buildings and improvement of the forests in other respects. This is satisfactory.

Cattle-grazing in the forests of the Bahraich Division.

87. The following figures exhibit the number of cattle which grazed in the different parts of the Bahraich Division during 1879-80, together with the estimated area of each forest district:—

Forest District.	Area, in square miles.	Cows and bullocks.	Buffaloes.	Sheep and goats.	Total.
Sohelwa	40	8,705	1,425	...	10,130
Bhinga	60	7,350	2,099	1,950	11,399
Charda	10	4,128	666	...	4,794
Chakia	20	2,500	200	221	2,921
Motipur	127	10,000	16,000	4,442	30,442
Total ...	257	32,683	20,390	6,613	59,686

These figures are supposed to be correct, but it is not probable that those entered for Bhinga represent the whole number sent for pasture into that forest. The area of the Bhinga Forest is estimated at 38,400 acres, and it is not likely that the pasture of 11,399 head of cattle could have the effect of clearing so large an area of grass. The average grazing revenue in Bhinga during the last three years has been Rs. 2,747 a year; and if the conclusion is correct that a much larger number of cattle actually graze than is reported, it ought to be possible to rectify the returns and in proportion to increase the revenue derived from grazing.

CHAPTER IV.

TRANS-SARDA FORESTS, KHERI DISTRICT.

88. The Trans-Sárda Forests in the Kheri District were gazetted as reserved forests, under section 34 of the Indian Forest Act, on the 28th February 1879.

The first steps towards defining the boundaries of these forests were taken in 1861 and 1862 by Mr. F. Read, then Conservator of Forests in Oudh, Mr. H. J. Sparks, B. C. S., then Assistant Commissioner, and Captain (now Colonel) F. C. Anderson, of the Revenue Survey. Their work related to the sál and sissoo forests only which are situated between the Mohán River and the high bank which bounds the high ground or damár on the south-west.

MAP
of the
RESERVED FORESTS
IN
Districts
KHERI & PILIBHIT.
Scale 4 Miles = 1 Inch.
Miles
REFERENCES.
Reserved Forest
Protected from Fire & grazing Hot Season 1881.
Wells
Forest Houses
Roads & Lines
District Boundaries
Pargana ,,
KHERI DIVISION
TRANS-SARDA
NEWAL-KHAR RANGE
I Forest Sunserpur
II ,, Sathiana
III ,, Newal Khar
IV ,, Chándan Chauki hut
V ,, Kulbaria
Sal.
KHAIRIGARH RANGE
I Forest Kusumbhi
II ,, Mohán
III ,, Majgaien
IV ,, Sisaiya
V ,, Nania
VI ,, Sanbirpur
VII ,, Ramnagar
PILIBHIT DIVISION
PILIBHIT RANGE
I Forest North Pilibhit
II ,, East Pilibhit
III ,, West Pilibhit
IV ,, South West Pilibhit
V ,, South East Pilibhit
PURANPUR RANGE
I Forest South Mála
II ,, North Mála
III ,, Maina Kot
IV ,, Mádho Tándah
V ,, Sherpur
Sal.
KHERI DIVISION
SHIRA RANGE
I Forest Katayia
II ,, Khamaria
III ,, Menaiegaon
IV ,, Kaptaura
V ,, Pahanapur
VI ,, Madha Dih
VII ,, Kharsta
VIII ,, Baraunsela
Sal.
PILIBHIT
Mádho Tánda
PURANPUR
Sherpur
Jitpurah
Grant Allenganj
Grant Harripur
Ramnagar
Gunchai
Deoria
Kasganja
Bisalpur
Marawri
Bamrawli
Negoni
Powain
Piparian
Khutrah
Sera Mau
Chándpur
Mailani
Salabatnagar
Bhir
Bhua
Ramnagar
Sarda or Gogra R.
Ahmadnagar
Gola Gokarnath
Guári Ghát
Sarda R.
Kaurála R.
Bahraich
Singhia Ghát
Kakrawla Ghát
Shardhapur Ferry
Singhia Kalán
Naraingabad
Naghasan
Lodhawi
Rakheti
Padhua
Shibba Ghát
Banbasa
Bela Parao deserted
Kheri
Nawabganj
Sonán
Kulkhan Ghát
Sakhia Ghát
Kheri Ghát
Kaptaura Ghát
Jahan R.
Kathna R.
Sarda R.
Gola R.
Deoha R.
Sarju R.
Ghágra R.
Kaurála R.
Chauka R.
Sarda or Gogra R.
Drawn in the Forest Survey Office by Bábu Jadunáth Náth from a Map supplied by Captain Wood Conservator of Forests Oudh Circle N.W.P. July 1881.
Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún August 1881.
C. Dyson, Photo.
C. B. Ollenbeck, Draw.

The limits of these sál forests were defined by temporary boundary marks, which have long since disappeared. The forests thus defined were surveyed by Captain Anderson in 1861-62, and drawn on a map, scale 2 miles =1 inch, which was lithographed in the Surveyor General's Office in March 1864, and a copy of which (in the corner of Captain Wood's Forest Map of Oudh) is appended to the Oudh Forest Report of 1867-68.

In 1867 certain areas outside the sál forests, which had been previously demarcated as grants under the Waste Land Rules, but which had not been disposed of by Government, were transferred to the Forest Department. Subsequently, Mr. John Kavanagh, the Boundary Settlement Officer, was appointed to demarcate the boundaries of the village lands adjoining the forests. Mounds of earth 3 feet high, with a post in the centre, were put up, and ditches, one foot wide and one foot deep, were dug connecting these boundary marks. The present boundaries are those laid down by Mr. Kavanagh.

These reserves are situated in parganas Palia, Bhúr, and Khairigarh, and the total area is about 265 square miles, stocked as follows:—sál forests, 146 square miles; sissoo and khair, 23 square miles; miscellaneous, 37 square miles; grass lands, 59 square miles.

Forest Rules of 1866.

89. The first rules made for these forests were the Oudh Forest Rules under Act VII of 1865. These rules declare eight* kinds of trees as reserved, *viz.*, sál, sissoo, túm, ebony, dhao, asaina, khair, and haldu. Rule 7 grants permission to all villagers living in the forests, or within three miles of the Government boundary line, to cut such timber as they may require for their own *bonâ fide* use for domestic and farming purposes, such timber not being any of the eight reserved woods. By Rule 12 grazing in the forests was prohibited. This last rule, however, has never been strictly enforced. The present state of matters in these as in most other forests of Oudh is, that the inhabitants of villages situated within the forests and within three miles from the boundary are permitted to graze their cattle at lower rates than the people beyond that limit, and that they are permitted to take, without payment, unreserved woods for fuel and for domestic and agricultural purposes, as well as thatching grass.

These are the privileges granted by the Forest Rules, and by subsequent orders passed by the Chief Commissioner prior to 1879. In May 1879 the Government of the North-Western Provinces and Oudh ruled that, over and above these privileges, poles for building purposes of ebony, dhao, and asaina, dead, fallen, or standing sál for ploughs, and sál timber for the construction of wells and bridges, should be given free to the people residing in the privileged villages.

Protection.

90. Broadly speaking, it may be said that the cutting of green sál, without permission, has been prohibited since 1859, or for the last twenty-two years. Until 1875 fires passed through the whole of the forests every hot season. Attempts were repeatedly made to protect against fire the blocks where fellings had taken place, and a small area in the immediate vicinity of Dudua, but without success. The first successful attempt to exclude fires over a considerable area was made in 1875, when a block measuring about 15 square miles near Dudua was taken in hand. Of this area a small portion has been successfully protected throughout, while the rest was burnt in the hot season of 1879. Arrangements have now been made to extend the protected block, and the total area taken in hand is estimated to aggregate 65 square miles.

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* The original rules only declared four reserved trees: dhao, asaina, khair, and haldu were subsequently added.

Effect of protection.

91. The effect of the protection of sál and the general protection of the forests since 1859 is manifest throughout the whole area; but there is a vast difference in the character of the forest between those portions through which hitherto the fires have passed every year, and those portions which have been more or less protected since 1875 in the vicinity of Dudua. In the forest which is situated between the high bank and the Sathiana line, and through which no fires have passed since the hot season of 1875, there is a dense undergrowth of young sál, asaina, and other kinds, and, except in a few low places, there is very little grass on the ground. A similar improvement is noticed in other parts of the forest near Dudua which have escaped fire. In the rest of the forests, however, the greater portion of the area is stocked with grass under the trees, except here and there where, owing to good soil, good drainage, and conditions otherwise favourable, thickets of coppice-shoots and saplings have sprung up. Such plots, stocked with a satisfactory young growth of poles and saplings, are found scattered throughout these forests; but they alternate with extensive tracts where the ground is covered with grass under the trees. Indications are, however, not wanting, even in such places where the ground is covered with grass, of improvement. Seedlings of sál and coppice-shoots from old underground roots are not uncommon among the grass, and although, under the action of the annual fires, most of them are cut down to the ground year after year, still some have survived, and their tops stand out from the grass. The general result of the observations made on the present examination of the forests is that no general improvement can be expected without protection from fire. Under existing circumstances, it will be necessary to be satisfied with the area taken in hand this year, but it will doubtless be possible eventually to add a considerable area in the northern corner of the Newalkhar Range, which is bounded by Nepál territory on two sides. For the present we must be satisfied with the 65 square miles now taken in hand.

Future treatment.

92. As regards the general management of these forests, the total area may most conveniently be divided into three great classes—*first*, forests protected from fire; *second*, forests not protected from fire, but intended chiefly for the production of timber; *third*, grass lands and inferior forests intended chiefly to furnish pasture. To the last named class belongs the area south-west of the high bank which bounds the sál forests, as well as the extensive grass lands north-east of the high bank and included within forest limits. In this class may also be reckoned the block stocked with miscellaneous forest along the Mohán, between the sál forest and the Kauriála.

Management of pasture lands.

93. Under existing arrangements, the Forest Department must provide pasture for the villages adjoining the forests, and for the people from a distance who have hitherto been accustomed to bring up their cattle for pasture. For this purpose the grass lands and miscellaneous forests mentioned should be utilized as much as possible. Of the whole area of low-lying lands situated south-west of the edge of the damár, only one small tract, on both sides of the Suheli, near Dudua, measuring about 500 acres, has been marked off and protected from fire, in order to promote the reproduction of sissoo; the rest of these lands is burnt every year, and, as they are chiefly required for grazing, there is no objection to utilizing the wood standing on them. Accordingly 573 sissoo trees were felled by the Ordnance Department in 1879-80, and arrangements have been made during the last few years to grant licenses to cutch-boilers (khairahas). The revenue realized from these two sources is not yet considerable, but will doubtless increase.

Those grass lands which are included within the protected area, or near its limits, are burnt every year early in the season to facilitate fire-protection, and these lands may likewise be used for pasture under proper precautions to prevent the firing of the forest. I may here mention that it would be a good plan to burn as early in the season as possible those grass lands also which are situated in the forests not included within the protected area. In some cases this may have the effect of protecting against fire some of the adjoining forest tracts.

Management of the Sal forests: dry timber: hollow trees for canoes.

94. Regarding the management of the areas stocked with sál, the most important point is to determine the arrangement of fellings.

As regards dry timber and trees which are half-dead, no special remarks are needed. Such trees, as well as cut and dead timber lying on the ground, are removed from the forests on permits, which are granted up to ten trees in each case by the Forest Ranger and for larger quantities by the Divisional Officer. Large hollow trees also are cut, hollowed out with the aid of fire, and made into canoes. Of these canoes about 150 a year are made for Government, to be used for rafting timber to Bahramghat; others are made by private persons. Trees sold for this purpose are marked by the Forest Guards, and cut and removed by the purchasers on their paying Rs. 25 for each boat. It may here be mentioned that the cost to Government of such a canoe is, for felling, hollowing out, and preparing, Rs. 17; for carting to the ghât on the Suheli River, Rs. 5; for filling in ends and caulking, Rs. 3: total, Rs. 25. These boats are, however, larger than those made ordinarily by purchasers, which sell for Rs. 60 on the Kauriála River.

The revenue realized from dry timber and the cutting of boats during the last three years has been as follows :—

	1877-78.	1878-79.	1879-80.
	Rs.	Rs.	Rs.
Dry timber	14,419	18,407	11,735
Boats	1,445	730	2,255
Total ...	15,864	19,137	13,990

The rule is, and this rule should be strictly enforced, that no boats are cut and no dry timber is removed from the forests protected against fire after the 1st March of each year. With this precaution, there is no ground for stopping the collection of dry timber and the cutting of hollow trees for boats in the block marked for fire-protection.

Selection fellings.

95. The annual selection fellings have yielded 49,687 trees, chiefly sál, during the twenty years from 1862 to 1881, or, on an average, 2,500 trees a year. During the last two years, however, only 2,000 trees a year have been felled.

It is believed that the working of the saw-mill at Bahramghat, and the sales at the depôt at that place, would give more satisfactory results if the annual quantity of timber sent to that place could be somewhat increased, so as to enable the saw-mill to turn out a larger quantity of scantlings. Two questions, therefore, arise—whether the annual fellings may be increased at the present time, and how they should be arranged to secure the greatest possible revenue and, simultaneously, the improvement of the forest?

Natural reproduction of Sal on clearings.

96. In para. 78 of this Report a remarkable instance of complete reproduction of young sál on the Nepál boundary line has been described; and

there are other instances in which compact forests of sál poles have grown up on ground which had been completely or nearly cleared of all large trees. Some instances of good reproduction of sál occur on the lines which were originally cut through these Trans-Sárda Forests to a width, in some cases of 50, in others of 100 feet, while only a road, generally 15 feet wide, in the middle of the line was kept open; but in all these cases the growth of young sál and other trees is unequal. Patches of compact young forest alternate with stretches in which there is no young growth. In the Dehra Dún Forests large areas stocked with compact masses of well grown poles occupy the places from which thirty or more years ago most large trees were cut out, and the same thing has taken place in the Bhira Forests and in part of Motipur. At first sight these instances might seem to justify the conclusion that the most appropriate treatment of the Khairigarh Forest would be to cut down every tree, so as to allow the forest to reproduce itself, as the Dehra Dún, Bhira, and Motipur Forests have done; but side by side with masses of poles in the forests named are extensive stretches in which the old forests have entirely disappeared and have been replaced by grass.

The result of my observations of the development of sál forests in different districts and provinces, extending over a period of eighteen years, is that on good well drained soil, and under otherwise favourable circumstances, young sál forest springs up if fairly protected against cutting, although most large trees had been cut out, and in spite of the annual fires; but that where the conditions are not favourable, the result of such treatment is the destruction of the forest.

Result of clearances at Dudua.

97. A systematic experiment to determine the result of natural reproduction of sál in forests where all large trees are cut down, was made by Captain Wood near Dudua in 1875 and 1876. On 80 acres all large trees, sál and others, were cut, only young vigorous trees, that would hereafter make good timber, and well shaped poles being left standing. In the 40 acres first cut these poles stand single, while in the area cut subsequently they were, at the suggestion of the writer of this Report, left standing in groups. About one-half of this area was successfully protected against fire, while the other half was burnt two years ago. The result of this experiment is exactly the same as what has been noticed on the cleared lines. Where circumstances were favourable, there are masses of poles and saplings; while elsewhere the ground is covered with high grass and with isolated trees of asidha and other kinds. It must, however, be said that, in that portion which has been protected from fire, there is a large number of coppice-shoots and seedlings of sál of all ages on the ground. On several sample plots stocked with grass on this area, the following numbers of young sál were counted :—

Year.	Area.	Number of young sál counted.	Per acre.
March 1879	Square yards. 605	306	
	605	483	
	605	437	
	605	303	
	605	292	
	605	209	
	605	255	
	605	362	
	1 Acre	2,647	2,647
February 1881	291 square yards.	93	1,547

There seems every reason to hope that over the greater part of this area the young sál will eventually get the upper hand of the grass.

Whenever a complete clearance is made, the first result is always to increase the quantity of grass on the ground, and thus to augment the risk from fires and to increase their violence. This is the chief reason why it is not advisable to clear away all large trees before the grass has been killed out and the ground has become stocked with young growth.

Principles to be followed in fellings.

98. The instances quoted of young sál forests which have come up where all large trees have been cut down, show that the growth of young sál is promoted by an abundance of light, but the risk through the increase of grass is too great to render complete clearances advisable. A safer plan certainly is to kill out the grass as much as possible, by increasing the cover overhead and by continued fire-protection; and the excellent results attained in the blocks protected from fire since 1875 clearly point to this course as the most appropriate in these forests.

As soon as any blocks or compartments are completely filled up with young growth, all trees which are marketable should be cut, and other trees which cannot be sold, such as asaina, should be killed by girdling. When this is done, after all grass has been previously killed out, it will be seen that poles of sál and other trees will shoot up with extreme rapidity, while at the same time the absence of grass will make fire-protection easy. In forests thus treated the chief difficulty will be that the proportion of asaina will in most cases be very large. To some extent this may be remedied by permitting villagers in the vicinity of the forests to cut poles of asaina for their requirements, and in some cases it may be an advantage to cut out the asaina poles on account of Government, though this may cause some expense.

The success obtained in the compartments continuously protected since 1875 justifies the expectation that five years hence the cutting out of all large trees in the protected area may commence, and may then be steadily continued throughout the whole area protected from fire.

Selection fellings to be continued outside the protected area only.

99. The plan, therefore, which I submit for adoption is this—to continue the present selection fellings outside the area demarcated for protection until fellings can commence in the protected area.

Assuming that the total area of the sál forests, Trans-Sárda, amounts to 150* square miles, the present proposals are to continue the selection fellings over 90 square miles, and to permit no cuttings of green timber, except for boats, in the 65 square miles of fire-protected forest.

It has been stated above that the selection fellings during the last twenty years have given about 50,000 mature trees; these fellings have extended over the whole northern part of the forest (including a portion of the protected area), or, say, over about 70 square miles. The southern part of the forest outside the area proposed to be protected may be estimated at about 40 square miles; but while 70 square miles in the northern forests have yielded at the rate of 714 trees per square mile, the southern portion, which was worked out much more in former years before it was taken charge of by the Forest Department, cannot be expected to yield more than, say, 350 trees per square mile. Thus the stock of mature trees available for the selection fellings outside the fire-protected area, under these proposals, is not more than 14,000 marketable trees. These estimates are based upon the figures furnished me by the Conservator, and they are necessarily extremely rough and uncertain. The error, however,

* In his letter to the Government of the North-Western Provinces and Oudh of the 27th August 1879, Captain Wood stated that these forests contained 180 square miles of sál: he now informs me that the area is only 150 square miles.

will be found to be on the safe side; and I am inclined to think that, if these suggestions are agreed to, we may venture upon cutting 2,500 green sál trees per annum, during the next five years, in the southern part of the forest outside the protected area; and that, if such should be required before commencing cuttings in the protected area, a few years' more yield may be taken from the northernmost blocks, where selection fellings were made about ten years ago, and where it may be expected that a number of second class trees have since that time attained to a marketable size. In this manner the needful annual outturn from the forests outside the area protected from fire has been provided for a period of, say, eight years, commencing with 1881-82.

The principles which have hitherto guided the selection fellings should continue to be maintained. These principles are to cut every marketable sál tree in girth above 6 feet, except such as are on the edge of blanks or in places where no other seed-bearing sál trees are near. It is further essential that the fellings should proceed progressively and in due order, no new compartment or other sub-division being taken in hand until the cuttings in that previously worked have been completed. It is most desirable here, as well as in the other forests of Oudh, to dispose of as much timber of asaina and other kinds as possible; and perhaps it will be found practicable to sell a certain quantity of such timber standing in those compartments in which selection fellings are proposed to be made during the next five years, as these compartments are at no great distance from the Kauriála River. The work of the Bahramghat saw-mill cannot, unfortunately, be increased by sending down asaina on Government account. The wood would, I am told, not sell readily in scantling; but, as an experiment, small quantities might be sent down and sold in the log.

Cuttings within the protected area.

100. So far regarding the cuttings outside the fire-protected area during the next eight years. Within the protected blocks it will be necessary to work in a different manner. But, as the cuttings within the protected blocks will not take place for some time to come, it will suffice here to submit a few general remarks, which should be kept in view. Outside the protected blocks the selection fellings proposed for the next five years cannot conveniently be regulated by area, but a maximum annual number of trees to be felled must be fixed instead; whereas within the protected blocks it will be necessary to regulate the work chiefly by area. In those compartments in which the young growth has advanced sufficiently to justify this operation, the whole of the marketable trees may be cut out, unless, indeed, it should be deemed advisable to allow groups of vigorous growing trees to stand, in order to increase their size and value. In no case is it likely that entire compartments all over should be completely stocked with young growth, and in such cases the cuttings must entirely be regulated with due regard for the development of the young growth.

As a special case, a limited number of trees may be felled annually in the area protected from fire, in anticipation of the regular fellings here proposed. It appears most desirable to open out an additional market for the timber of the Trans-Sárda Forests in the Sháhjahánpur District; and, in order to bring this about, I suggest that a few hundred pieces of sál timber, of first-class quality, be sent annually across to a depôt to be established at Máiláni or elsewhere near the western edge of the Bhira Forests, to be sold there by periodical auction sales, or otherwise, as may be found most advantageous. I am inclined to believe that this measure will lead to the revenue from the Trans-Sárda Forests being increased considerably; and that it will eventually lead to the re-establishment of a bridge of boats over the Sárda River, between Dudua and Bhira, to facilitate the carriage of the timber which may, as a special case, be cut in the protected block near Dudua.

Summary descriptive account of compartments.

101. As soon as protection has been fairly established over the whole area here proposed, I would suggest that a summary descriptive account of each compartment be drawn up.

It will be convenient to designate as compartments all plots which are separated from each other by cleared lines, of which a perfect and admirable system has been laid through the whole of these forests. There is no object in making these compartments all of one size, but in some cases, where the compartments are inconveniently large, it will be well to sub-divide them by cutting additional lines. By way of illustration of what is intended, I may mention the seven compartments situated between the main Guarighat line, the high bank, and the Suheli line No. 3. Of these the two which are situated between Dudua and the Domuhani depôt line are much smaller than the others, but this is no disadvantage. These compartments are necessarily artificial subdivisions, and the forest growth in one compartment cannot in all cases be expected to be uniform.

The descriptive account of compartments here suggested should be brief and summary. It should state the area of grass lands and the area stocked with forest, and it should give a brief statement of the young growth, whether complete or otherwise, and of the larger trees over-topping it. In order to form some idea regarding the proportion of trees of different classes, of sál and other kinds, it would be well if linear valuation surveys were made to determine the number of trees of the first three classes, *viz.*, above 6 feet in girth, from 4 feet 6 inches to 6 feet, and from 18 inches to 4 feet 6 inches. It will suffice to count separately (1) sál, (2) asaina, (3) trees of other kinds. At present I do not advocate that complete countings be made of entire compartments, and I do not believe that in these forests any practical object would be gained by counting the trees in small sample areas, as the character of the forests varies too much. The best plan will probably be to make two linear surveys through the whole breadth of each compartment. For this purpose it will suffice to count the trees of the kinds and classes mentioned on a width of 50 feet on either side of the line followed, or on a total width of 100 feet. Two counting officers on an elephant, each furnished with bamboo tallies, as used in Burma, can do all the counting; and the establishment required will consist of the men to chain the length of the line, two men with a 50-foot rope to assist in determining whether any particular tree is within or outside the 100-foot belt, and one man with a shorter rope, six feet long, with knots at 18 inches and 4 feet 6 inches, to assist the counting officers in gauging the girth of the trees counted.

The line should as much as possible be laid straight through the forest, avoiding large grassy plains, which should be deducted from the area of the compartments. Before cuttings are commenced in any compartment, a detailed examination of it should be made, in order to determine whether the forest is fit for the cutting out of the large trees.

It would be an advantage if this summary descriptive account of all protected compartments could be completed before cuttings commence, as this would make it possible to frame a sketch working-plan, and to form some idea regarding the annual yield that may be expected from the area protected against fire.

Periodical measurement of Sal trees.

102. In order to determine the rate of growth of sál, Captain Wood has in this, as in the other forests of the Oudh Circle, commenced an excellent system of periodical measurements of trees of different sizes. The great difficulty in determining the annual ring in the wood of sál, makes these periodical measurements a necessity; and if the system initiated by Captain Wood is steadily continued, it will probably, within the next five years, give results sufficiently reliable to be used in framing a preliminary working-plan

of these forests. These measurements were commenced early in May 1880, and the mean increase in girth, within the six months between that date and the beginning of December, has been as follows:—

25 trees near Dudua, standing more or less isolated, in girth between 3½ feet and 6½ feet, gave a mean increase in girth of 1·48 inches.

Sample plot No. 1, area ¼ acre, 24 trees, in girth between 1½ feet and 5½ feet, gave a mean increase in girth of 0·86 inches.

Sample plot No. 2, area ¼ acre, 20 trees, in girth between 1½ feet and 7 feet, gave a mean increase in girth of 0·94 inches.

Sample plot No. 3, area ¼ acre, 32 trees, in girth between 1½ feet and 6½ feet, gave a mean increase in girth of 0·64 inches.

Sample plot No. 4, area ¼ acre, 35 trees, in girth between 1½ feet and 3½ feet, gave a mean increase in girth of 0·91 inches.

In order to ascertain the increase during the dry season and the monsoon, it is intended, here as in the other forests, to make measurements in future about the 1st June, 1st December, and 1st March. Besides the general remarks submitted in regard to the sample plots in Bhinga and Motipur, I have only to suggest, in the present case, that a larger number of trees on the partially cleared ground near Dudua be measured, including some of the larger sizes, and that, instead of the four quarter-acre plots, one plot of two acres be selected in a locality as completely stocked with trees as possible. On this two-acre plot all suppressed trees, and others not likely to form part of the final crop, should be thinned out, and all the remaining trees, whether sál or other kinds, should be measured. The advantages of selecting one larger block are obvious, the chief being that the disturbing influence of blanks, or large trees standing outside near the edge of the plot, is eliminated. If arranged in the manner here indicated, these measurements will not only give the increasing girth of individual trees, but will also furnish some data for estimating the annual production of timber per acre; and eventually these plots may be used to ascertain the accelerating effect of heavy thinnings upon the growth of the remaining trees.

Revenue and Expenditure.

103. The revenue and expenditure on account of the Khairigarh Forests cannot be completely stated, as the sales of the timber extracted on account of Government appear in the accounts of the Bahramghat Division. The following figures, therefore, do not give a correct view of the financial results:—

Revenue.

Items.	1877-78.	1878-79.	1879-80.
	Rs.	Rs.	Rs.
Sale of Sissoo	174	150	140
Canoes	1,445	730	2,255
Dry timber	14,419	18,407	11,735
Depôt „	8,122	4,648	29,906
Dead „	100	195	304
Catechu	...	...	3,665
Grazing	12,738	11,359	15,502
Other item	2,324	1,823	2,512
Total ...	39,322	37,312	66,019

Expenditure.

Items.	1877-78.	1878-79.	1879-80.
	Rs.	Rs.	Rs.
Timber expenses	41,376	56,297	55,342
Other revenue charges	777	852	882
Live and dead stock	5,899	5,185	5,264
Communications and buildings	10,536	8,023	12,472
Demarcation and improvement	2,125	3,803	3,171
Miscellaneous charges	848	529	480
Establishment „	17,045	19,677	19,376
Total ...	78,606	94,371	96,987

Local establishment and cost of protection from fire.

104. The present Trans-Sárda Forests are divided into two ranges, the Northern or Newalkhar Range, and the Southern or Khairigarh Range, each in charge of a Forest Ranger. Each range is divided into four beats, each beat being in charge of two Forest Guards.

To assist in fire-protection, additional men are entertained, and the number hitherto employed for this purpose on the Dudua home block has been as follows:—

1	Darogah,	at Rs.	20	per mensem,	for 5 months.
1	Jemadar,	at „	10	„	for 5 „
44	Watchers,	at „	5	„	for 5 „
14	„	at „	4	„	for 5 „

The total cost of the fire conservancy establishment for the last three years has been—

	Rs.
1877-78	1,033
1878-79	1,968
1879-80	2,721

CHAPTER V.

BHIRA AND PILIBHIT FORESTS.

105. West of the high bank which runs parallel with the Sárda River extends a long stretch of high ground stocked chiefly with sál. The northern part, an extensive sál forest, is situated in the Tarái District, where it is known as the Bilheri Forest, and in pargana Púranpur of the Pilibhít District; while the southern part, commonly known as the Bhira Forest, is in pargana Bhúr of the Kheri District in Oudh.

The forests of the Pilibhít District consist of two belts, like the arms of a horse-shoe, enclosing a belt of open country, from 12 to 18 miles wide, in which are situated the large villages of Mádho Tánda and Púranpur.

The forests of pargana Púranpur occupy the inside of the western branch, as well as the top and eastern branch, of the horse-shoe; while the forests of pargana Pilibhít occupy the west side of the western branch, being separated from those of Púranpur by the Mála swamp. The Bhira Forests are a continuation of the Púranpur Forests. The area of the Government forests west of the Sárda River in the Pilibhít and Kheri Districts is as follows:—

			Acres.
Pilibhít	Pargana Pilibhít		29,434
	„ Púranpur		65,361
Kheri	„ Bhúr		90,051
	„ Mahamdi		7,840
		Total ...	192,686

In charge of the Forest Department are also a few blocks of waste land in the Hardoi District, chiefly stocked with dhák *(Butea frondosa)* and thorns.

Open glades with stunted Sal.

106. Of the total forest area in Pilibhít and Kheri, by far the greater portion is stocked with sál, but there are also extensive stretches of grass land and open glades of stunted sál. These open glades, with grass and stunted sál, are a feature peculiar to the sál forests in Pilibhít and Kheri west of the Sárda River. I have not noticed them east of the Sárda. At the time of our visit in February, they presented a peculiar appearance—the dark brown leaves of the sál, burnt by the frost, standing out from the dry grass, mingled with the foliage of the yellowish-green dwarf date-palm, which is exceedingly common in such places. After the rains, before the night frosts of January have set in, the bright green of the sál leaves gives these glades a very pleasing appearance, and at that time they look like promising saplings, likely to grow up into a most valuable forest.

These sál shoots are killed down to the ground by the frost of every successive year, and the fires of the hot season, which have hitherto occurred regularly, sweep away both the dry grass and whatever may have been left of the young sál coppice. The underground roots, however, survive and send forth fresh coppice-shoots during March and April, which continue to grow for nine months, until the next frost cuts them down. Where the soil is at all good these coppice-shoots frequently attain a sufficient size to resist the frost, but on poor sandy soil the shoots of one season are only 4 to 5 feet long, and are therefore cut down by the night frosts of winter. These glades, which, as observed, form a characteristic feature of these forests, are always found on poor sandy soil, occupying stretches both of high and of low ground. Where fire conservancy has commenced there is no doubt that the soil will gradually improve by the decay of grass and leaves, and it may be confidently expected that then the coppice-shoots of spring will attain a sufficient height in one season to raise their tops above the frost level. The gnarled underground root-stocks, which send forth the coppice-shoots year after year, are of great age. They attain a large size and a remarkably irregular shape, but are generally hollow.

Forests in the Kheri District known as the Bhira Grants.

107. As regards past history and treatment in future, the forests may be conveniently divided into three portions, *viz.*, those of the Kheri District and those of the Púranpur and Pilibhít parganas of the Pilibhít District.

The forests in the Kheri District west of the Sárda, which are generally known as the Bhira Grants, were granted under the Waste Land Rules of 1860,

and were subsequently resumed, either because the grantees failed to clear the proportion of the land which had been stipulated, or because they failed to pay the revenue for which they were liable.

The grantees had possession of these lands without any obligation to provide the people of the neighbouring villages with wood, grass, or other forest produce, or to permit their cattle to graze in the forests. The lands were transferred to the Forest Department, after having been resumed, between the years 1870 and 1875, and they were held free of all forest rights or privileges, no produce of any kind being removed without payment.* In June 1879 the Government of the North-Western Provinces and Oudh directed that all villages situated within three miles of the boundary of these grants should receive free, for their own requirements, wood (not of the reserved kinds), grass, and other forest produce. The grantees had been under the obligation of paying road and other cesses on account of their grants, and, when passing the orders adverted to, the Government directed that no cesses should be paid on account of those grants which had been transferred to the Forest Department, in consideration of their providing forest produce free to the adjoining villages.

Proposed exchange of certain lands.

108. Two exchanges of land have been proposed to be made, in order to consolidate the forest property in these districts, but they had not been finally sanctioned at the time of my visit.

Five blocks in the Hardoi District, aggregating 3,160 acres, and two blocks in the Kheri District, measuring 1,128 acres—total 4,288 acres—in exchange for two pieces of sál forest, the one situated at the southern end of the Barauncha Forest, and the other (part of Allenganj) situated in the most northerly corner of the Kheri District, on the border of the Pilibhít District, aggregating 4,206 acres; and 2,618 acres of grass land near the Sárda, east of the villages of Kamp and Kishanpur, against 2,939 acres of sál forest adjoining Allenganj and generally known as Grant Harripur. These exchanges, if effected, will much facilitate the organization and consolidation of these forests.

Boundaries how defined.

109. The boundaries in these forests are marked by the old masonry pillars by which the grants were originally demarcated. A shallow ditch, 12″ × 6″, was dug from pillar to pillar, but these ditches have, where the soil is sandy, become obliterated. A commencement has now been made to mark the boundaries in a more permanent manner by a ditch 3′ × 3′, and this has been completed over a length of 21 miles on the western side. The forest boundaries adjoin cultivated land on the east side, south of Bhira. In all other places the forests are surrounded by private forest lands, the property of grantees or of zamindars in the districts of Kheri and Sháhjahánpur.

Protection.

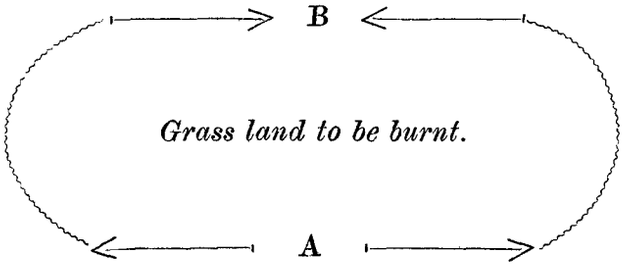
110. These forests have now been protected against miscellaneous cutting during a period of from six to eleven years. In the extensive stretches of poor sandy soil, which occupies a large portion of the area, no great improvement is noticeable, but wherever the soil is good the forests have filled up, and in many places there is a considerable stock of well grown sál poles on the ground. The forest has been well protected against indiscriminate cutting since it was taken charge of by the Forest Department. The annual fires have, however, swept through it, with the exception of those plots in which the forest growth had become so thick as to kill the grass. Instances are the Katayia block, north of Kishanpur, the forest south of that village, and the forest east of the Ul outside the fire-protected block.

* In 1871, when Colonel Stenhouse was officiating as Conservator, he attempted to introduce a system of commutation for the villages in the vicinity of the forest, each household paying one rupee per annum for the right of providing themselves with forest produce for their own requirements. This plan, however, was only partially carried out.

Fire conservancy.

111. The first special measures to exclude fires were taken in 1878, and the forest south-east of Mádha was protected during the hot season of that year. The protected block has been extended gradually every year, and the area proposed to be protected during the hot season of 1881 may be estimated to measure 21,000 acres. This block is bounded on the east by the wide stretch of grass land through which the Ul River runs, and extends westward to the open country near Mailáni and the high road from Kukra to Mailáni. Protection is effected chiefly by burning the whole of the forest outside the boundary, and by setting fire to all enclosures of grass land in the reserved block and on its edge. In carrying out this latter operation great care has to be taken. Two consecutive seasons are seldom similar, and require entirely different treatment. Thus in some years the grass is very green and will not burn until late in the season. In other years the whole forest burns readily as early as December. The grass often obstinately refuses to burn without a good breeze, when the fire is as likely as not to get completely out of hand, and the whole reserved block will be endangered. Experience has shown that in unfavourable seasons the best plan is to burn at night in February and March, after the frosts of winter have been succeeded by a warm sun. After the successive action of intense cold and heat the grass burns readily.

Burning at night is carried out in the following manner. A still and clear night is chosen (moonlight if possible), and burning commences along the edge of the forest against the direction of any slight breeze that may spring up. Two gangs, of about 30 coolies each, are placed under an intelligent Ranger or Forester, and they burn the grass in opposite directions, starting from point A in the diagram below—



One gang burns to the right, the other to the left, extinguishing the edge burning towards the position desired to be protected. These gangs work round until they meet at B, on the opposite side of the area stocked with grass proposed to be burnt, thus leaving a burning mass in the centre. This practice has been adopted with success by Mr. C. J. Ponsonby, Deputy Conservator of Forests. Here, as in the other Oudh Forests, it is of the utmost importance that all grass lands included in the forest and on its edge should be burnt as early in the season as possible, when the grass under the shade of the forest is as yet too green to burn. At the outset all extensive grass lands must be sacrificed in order to protect the forest. Protection is further facilitated by the complete system of roads laid through the forests. These roads and the watch-towers built of wood enable the fire-watchers to discover any distant fire, and enable them to isolate the blocks by counter-fires. For the protection of the 21,000 acres taken in hand, 30 fire-watchers under one Forester are required in addition to the regular protective establishment. These men are all natives of the villages in the vicinity, and receive pay at the rate of Rs. 4 per mensem. They are entertained during a period of from four to six months. The total cost of protecting this area of 21,000 acres is Rs. 1,200 a year, which is at the rate of about Rs. 60 per 1,000 acres. In future it is expected that the cost of fire-protection will be much less. In the block selected for fire conservancy are included considerable stretches of poor sandy soil, the protection of which is difficult, owing to the open nature of the forest and the abundance of grass on the ground. In such places results will be very slow in

showing themselves. A large portion, however, of the area under protection is good soil, and this portion has already greatly improved, the undergrowth being a thick mass of young sál and other trees. In considering the further extension of the fire-protected area, such blocks with good soil should always be selected in preference. I would specially draw attention to that portion south-west of the Mailáni-Kukra road, and to the forests south of Kishanpur. Other things being equal, it is preferable to select for fire-protection as large an area as possible near the western edge of the reserve which is nearest to the market.

Cuttings.

112. In the fire-protected block no cutting or thinning will be advisable for many years to come: here the great aim must be to make the forest grow up as thick as possible, so as to kill the grass and make fire-protection in the future easier and more economical. Outside the area, however, that is likely to be included in the fire-protected block, it will be most desirable every year to cut a certain quantity of poles and trees, in order to supply the adjoining open country in the Sháhjahánpur District.

In para. 100 of the present Report it has been proposed to establish a depôt outside the eastern edge of these forests, and to stock this depôt with wood brought across from the Trans-Sárda Forests. This depôt will probably be somewhere west of Mailáni. At present, while the large area of forest in private hands on that edge of the Bhira Reserve has not yet been cleared, it would be premature to cut any poles in the Government forests to supply this depôt, although eventually it is probable that the establishment of such a depôt will secure fair prices for such material.

There are, however, several outlying blocks further south, along the Kathna River, which it would be inconvenient to take in hand on account of their distance from the main Bhira block, and which are mainly required to furnish pasture. The wood standing on these blocks might gradually be cleared, and there would probably be no difficulty in selling it at remunerative rates, one compartment after another being taken in hand in succession. This suggestion is made on the assumption that the restriction on the cutting of wood in the forests near the Kathna River, which has been imposed in view of carrying out the Kathna reclamation scheme, will be removed.

Roads, rest-houses, and wells.

113. In the centre of the system of roads and lines by which this forest has been made accessible is the double-storied forest-house at Madha, situated on the high ground at the edge of a wide and long belt of grassy plain, on the site of an old deserted village, with two old brick wells that have been repaired and built up by the Forest Department. From this point lines radiate in all directions, and a continuous forest road *viâ* Kishanpur to Jatpura and the Pilibhít Forests is under construction. A peculiar feature in the system of lines and roads in this division are roads which follow the edge of the high ground and forest along the open glades of the Ul and Barauncha Rivers. These roads follow the edge of the high ground, and are known as the Ul and Barauncha "serpentines." All roads are 15 feet wide, excepting the main road from Bhira to Mailáni, which has a width of 20 feet. Altogether there are 60 miles of road; and besides the rest-house at Madha already mentioned, there is one of the same class at Gola in the open country, and smaller one-storied houses are in course of construction at Kishanpur, Bhira, Kukra, and Ambara. These smaller houses are on a very good pattern for the hot season, with a tiled inner roof and a large projecting thatch roof over it, with a space of six feet between the two roofs. There is a well near each rest-house, and altogether there are eleven good wells in the Bhira Forest, some of which are quite new; and a tank, 100 feet square, has been excavated at Madha. Most of the roads are extensively used for cart traffic, and they replace the numerous meandering cart-tracks which formerly connected the villages near the Sárda River with those on the west side of the forest. There is not sufficient dry wood

for export, but eventually, when cuttings can be commenced in the fire-protected block, these roads will facilitate the disposal of the wood cut, and they have already stimulated the export of grass and other produce from the forest. Altogether a great deal has been done to open out these forests in the last two seasons, and this will not only increase the revenue and facilitate protection, but will also have the effect of making them more healthy.

Periodical measurements of trees.

114. There are three quarter-acre plots which have been marked off for the periodical measurements, *viz.*, one at Kishanpur, one at Madha, and one at the Bargad fire-chauki on the Bhira-Mailáni road. It will be preferable to substitute one plot, measuring at least one acre, for these three separate small plots; and this plot should be selected with as large a proportion of sál poles as is possible, and all mis-shapen trees, or trees that are suppressed and will not eventually form a portion of the final crop, should be thinned out and all the remaining trees should be measured. The plot selected should be well stocked with trees and without any grass.

Revenue and Expenditure.

115. The revenue during the last three years has been as follows:—

Items.	1877-78.	1878-79.	1879-80.
	Rs. A. P.	Rs. A. P.	Rs. A. P.
Wood, including fuel	727 6 3	1,138 7 3	354 9 1
Grazing	3,739 4 0	5,849 12 0	3,234 14 9
Thatching grass	100 8 4	189 4 0	290 12 3
Mohwa	22 0 0	105 0 0	70 0 0
Baib	314 13 6	549 11 10	387 15 6
Other sources	678 3 0	401 1 9	623 12 5
Total	5,582 3 1	8,233 4 10	4,962 0 0

All produce is removed by purchasers. The most important items of expenditure during the same period have been as follows:—

Items.	1877-78.	1878-79.	1879-80.
	Rs. A. P.	Rs. A. P.	Rs. A. P.
Revenue charges	391 0 0	392 0 4	655 15 9
Live and dead stock	920 13 7	743 5 0	815 8 0
Communications and buildings	2,575 14 6	2,156 8 7	3,509 14 8
Demarcation and improvement...	1,042 7 2	948 3 4	1,804 5 6
Establishments	2,491 9 7	4,128 9 2	9,435 3 9
Total	7,421 12 10	8,368 10 5	16,220 15 8

The local permanent establishment consists of one Ranger on Rs. 50 and 8 Guards on Rs. 10, Rs. 8, and Rs. 6 per mensem: this is certainly a very small establishment for the management and protection of 102,000 acres. As a matter of fact, it has been found to be quite insufficient, and I am informed that it has been found necessary to supplement it by entertaining a large temporary establishment regularly year after year.

Forests in the Pilibhit District.

116. The Government forests of the Púranpur pargana, which were gazetted as reserved forests in February 1879, are in an extremely poor and unsatisfactory condition. They are nothing else but waste grass lands, with stunted trees and bushes, chiefly of sál, devastated annually by the fires of the hot season and subject to almost unrestricted cutting. The sál poles which are not cut, and which survive the frosts of winter and the fires of the hot season, generally attain a height of from 10 to 15 feet within three years, and when at that size they are cut for rafters, which are used in the neighbouring villages.

Condition of the Puranpur Forests contrasts with that of the adjoining forests.

117. The contrast between the Government forests of the Púranpur and those of the Tarái District which adjoin them, as well as the private forests which are the property of zamindars, is exceedingly marked. It afforded me great satisfaction to see the southern edge of the closed block in the Tarái, which has during the last few years been protected against fire by Mr. Macdonald, the Superintendent of the District, and against indiscriminate cutting during a much longer period. Since 1875, when I first visited this portion of the Tarái Forest, the sál poles have increased in height, and the ground is well stocked with young sál and other trees. Adjoining the Tarái is the fire-protected block of the reserved forest in pargana Pilibhít, which has been protected against fire and cutting during the hot season of 1880, and here some improvement is already visible. The forest of the zamindar of Maina Kót, north of that village, which has been carefully protected by the proprietor for some time, is also in good condition, and contrasts in a marked manner with the surrounding Government forest. These are on the northern edge of the Púranpur Forest. The southernmost end adjoins the forests of the Sherpur zamindar in the Sháhjahánpur District, which are likewise carefully preserved and are in very good condition.

Puranpur Forests used without restriction, and without payment, by the adjoining villages.

118. The difference in the condition of the Púranpur Forests and those which surround them is not due to any difference of soil or climate. The reason why the Government forests of the Púranpur pargana are in such an unsatisfactory condition is that, as a matter of fact, they are burnt every year, and are open to grazing and to indiscriminate cutting and removal of forest produce required by any village in pargana Púranpur. All this pasture and forest produce is furnished free and without payment. Besides the Maina Kót and Sherpur Forests already mentioned, there is, on the outside of the Government forests, a fringe of forest, varying in width, which belongs to zamindars. The wood on these lands is also cut indiscriminately, but the zamindars exact payment for all produce taken from them. The origin of the existing state of things was an order by the Commissioner of Rohilkhand, of the 10th January 1850, which conferred on all Púranpur villages extensive rights in all the waste lands. In the Appendix to the present Report will be found an extract from a letter from the Deputy Collector of Pilibhít, to the Collector of Bareilly, explaining the status of the waste lands in Púranpur.*

Forests divided into allotments called grants.

119. In 1848-49 the waste lands in Púranpur, about 75,000 acres, were mapped out and divided into 22 allotments of 3,000 or 4,000 acres each. One of these allotments was a small mouzah, Mustafabad; the remaining 21 were termed grants, and were apart from the málguzári area. A number of these grants were made in 1853-54 to grantees under certain conditions,† the chief of which was that a certain proportion of the area was to be cleared and cultivated within a fixed time; a further condition being that the grant should convey a right

* Appendix No. IV.

† For copy of grant see Appendix V. to the present Report.

to the land for the purpose of cultivation and to all the products of the cultivated land, but should not give a right of property in the spontaneous products of the land. It was provided that whenever any persons had been accustomed to use or consume these products, the grantee should not interfere with them, and that "where no customary right to such products exists, the Government, if it does not require the products itself, permits the grantee to use or to consume them, subject to such conditions as it may impose".

Resumed grants declared reserved forests.

120. In three cases only (No. 1, Carew and Company; No. 8, Mustafabad; and No. 21, Dhakkai Chát) were the grantees supposed to have fulfilled the conditions required from them,* and the lands comprised within these grants are now in the possession of grantees or their successors. Of others a small proportion only was brought under cultivation; and the balance not cleared and cultivated, as well as the grants not taken up at all, have been included within the area declared reserved forest, in March 1879, under Section 34 of the Indian Forest Act. That section provides that if any rights of the Government or private persons in or over any land or forest produce, in any forest declared a reserved forest under that section, have not been enquired into, settled, and recorded in a manner which the Local Government thinks sufficient, the same shall be enquired into, settled, and recorded in the manner provided by the Act for reserved forests, and until such enquiry, settlement, and record have been completed, the declaration of Section 34 shall not abridge or affect any such rights.

If, therefore, the grant made in 1850 is held to constitute a right, the proprietary rights of Government in the Púranpur Forests are limited by and subject to such rights.

Record of rights at settlement.

121. Paragraph 64 of the Report on the settlement of Pilibhít by Mr. Elliot Colvin, C. S., of March 1872, which relates to Púranpur, is as follows:—

"Subsequent to the last settlement, the forest tracts were marked off into grants, and a few lots were in various ways disposed of to private individuals. The remainder are managed as forests. They, in common with the Pilibhít Forests, are immediately under the local civil officers, in subordination to the Forest Department. Their income and expenditure have been included when writing of the Pilibhít Forests. While so many acres remain uncultivated in the pargana, there seems no need to uproot these forests, though they are of little value. They consist of stunted sál, dhák, simal, haldu, and other inferior woods. The cultivators resident in the pargana may graze their cattle free of cost in them. The spontaneous products of the Tarái portion of the pargana are the property of the landlords, who derive not an inconsiderable income from the trees, grass, hides, grazing fees, &c."

The following is an abstract of the register of rights in the Púranpur Forests prepared by the Assistant Collector, Mr. W. Lambe, in 1876:—

"*Register of rights.*—The rights of third parties, being villagers residing in the pargana, are as follows:—fuel, wood for ploughs, koron, thúnee, bandelis, saintha, and narkul, wood for sugar-mills, pula grass, grazing cattle, bagolu, twigs of trees. The inhabitants enjoy these rights without payment.

Rights of way.—Only one road, that between Pilibhít and Púranpur, passes through this forest."

It will be for Government to decide whether the settlement and record here quoted are considered sufficient for the purposes of the Act, or whether it will be necessary to institute a new enquiry and make a new settlement and record.

Control of these forests by Government.

122. It must, however, be borne in mind that, whether the grant of 1850 conferred a right or only a privilege, Government has retained the control over

* It is doubtful whether these grantees did fulfil the conditions as regards bringing a certain area under cultivation; but, as a matter of fact, they are in possession.

these forests. Government has always let the right to cut wood, to collect minor forest produce, and to pasture cattle, to contractors who, during the time of their contract, became invested with the residuary rights of Government in these lands. It must also be remembered that the rights or privileges of the agricultural population are restricted to the produce required by themselves, and that they are not permitted to sell any of the produce thus obtained. Cases have occurred in which large quantities of wood have been brought from the Government forest by the right-holders and sold or used for other purposes, such as sugar manufactories; and in such cases it is not easy to prove that the conditions under which the forest rights may be exercised had been violated. Such cases and the apprehension that, if the forest continues to deteriorate as at present, a time must come when the area of Government forest will no longer be equal to supplying the people in pargana Púranpur, have induced the local officers to consider how the management of these forests can be placed upon a more satisfactory footing.

Formation of Village Forests not feasible.

123. The chief object of a conservancy management of these forests is to provide for the permanent supply of forest produce to the villages of the Púranpur pargana, and the question may be asked whether it would not be feasible to constitute these areas Village Forests under the Act. The reply is that there are no village communities to whom the care of these forests could properly be entrusted. Under the existing conditions of the settlement, these lands must either be managed by Government or they will fall into the hands of the zamindars, and in the latter case the permanent interests of the villages will in no way be benefited.

Proposal to require free passes to be taken out by the holders of rights or privileges.

124. Two measures have been proposed—*first*, to require right-holders to take out free permits for the produce removed by them from the forests; and, *second*, to close certain selected blocks. As already stated, it has not yet been fully established whether the user of these forests is exercised by the people of Púranpur as a right or only by permission; and under these circumstances it is probable that either measure—the issue of free permits by Government, or the closing of selected blocks—is justified, provided the requirements of the people are adequately supplied. The system of requiring the people to take out passes or free permits was commenced in May 1879. It was arranged that passes to enable the inhabitants of the Púranpur pargana to take out forest produce should be granted by zamindars, patwaris, and chaukidars of villages, and that a record of these passes should be kept by zamindars and sent to the Forest Department. This system, however, has not worked satisfactorily, and it has now been proposed by the local Forest Officers to entrust the granting of these passes to the Government Forest Guards.

There is little doubt that, if such a system can be thoroughly carried out, its effect would be to diminish the waste which has hitherto gone on in these forests. But the task which Government would undertake would be exceedingly difficult, and would give rise to illegal exactions on the part of forest subordinates and to complaints on the part of the people. The only consideration which can justify the adoption of such a system is this, that, unless some steps are taken to diminish the present waste, the forests must sooner or later prove unequal to the demands made upon them by the inhabitants of the pargana.

Proposal to close certain blocks.

125. A much better plan, and one less open to objections, is the proposal to close certain selected blocks and to protect them against fire, grazing, and

cutting. Even on the assumption that the grant made in 1850 conferred legal rights, this proposal is not open to objection, provided a sufficient area conveniently situated remains available to supply the requirements of the people. The Conservator proposes, in the first instance, to close that portion of the forests which forms, as it were, the head of the horse-shoe, and which measures 12,800 acres, an outer fringe being left on the south side for the supply of the people north of Madho Tánda. This closed block will thus be bounded on the south by a belt of forest proposed to be left open, on the north-west by the forests of the Tarái District, and on the north-east by a few villages near the Sárda, which are otherwise well supplied with forest produce. After the protection of this block has taken effect, it is for consideration whether a second block on the eastern edge further south, near Dhanauraghat, should not be taken in hand also.

Measures proposed.

126. Under existing circumstances, the demands by the people upon the Púranpur Forests are so great that any attempt to conserve and to improve the whole of the forests must be regarded as hopeless. Under the operation of frost, fire, and unrestricted cutting and grazing, these forests must go on deteriorating until at last they are reduced to the condition of grass lands, with here and there a few bushes of sál and other kinds.

The only practicable remedy that I can suggest is to demarcate and close permanently as large an area as possible, and to improve its condition steadily by fire-protection and planting. Under the Indian Forest Act it will probably be possible to withdraw this closed area entirely from the exercise of rights and privileges; and when it has improved sufficiently to be worked, cuttings must then be made departmentally, and no produce must be removed without payment. In order to facilitate this measure, it will be good policy to abandon the system of free passes; and it is for consideration whether, in order to obtain complete control over the closed blocks, Government should not also abandon the right, which it has hitherto exercised, of letting contractors cut wood and timber and collect forest produce.

The aim in the management of the Púranpur Forests should be, instead of attempting to control the user by the villagers over the whole area, to close certain selected blocks with the view of improving their condition, so as to make it possible eventually, when the resources of the open forest are exhausted, to provide the requirements of the people of Púranpur from the closed portion. The user of the open forests will remain free as heretofore, but for all produce removed from the closed and improved blocks due payment should be made. What is here suggested amounts to this, that a separation of the forest lands be made, selected blocks being set apart to be permanently maintained as forest; while the rest is thrown open to the people of the pargana, no attempt being made to secure its protection.

Forests in pargana Pilibhit.

127. As already stated, the forests of the Pilibhít pargana form a belt on the west of the Málá swamp, extending from the Tarái District in the north to the road from Pilibhít to Púranpur in the south. From these forests the inhabitants of the adjoining villages* are not permitted to take out any produce free, and the forests may be considered as being at the entire disposal of Government.

* As a temporary measure, certain privileges were granted to and enjoyed by the village of Máhof, but the order granting these privileges no longer holds good. Another privileged village was Barachanda, but it is deserted, and the land has been included in the forests.

Settlement Report.

128. The following is an extract (paragraph 42) from the Report on the settlement of Pilibhít, by Mr. Elliot Colvin, C. S., of March 1872:—

"The area of forest land belonging to Government consists of 28,361 acres* in pargana Pilibhít. This tract is situated on its eastern boundary. It runs north and south, fringing the Mála. It consists of stunted sál, haldu, and other inferior woods. The land on which it is situated is, it is true, comparatively high, but still the spring-level is so soon reached by the roots that it is impossible for the trees to become ever really valuable. It is managed by the local authorities, in subordination to the Forest Department. Duties on exports are levied according to a fixed schedule. The average income for the last five years has been, including Púranpur, Rs. 6,104: the main sources whence it is derived are grazing dues, duties on grass, firewood, charcoal, &c. The average expenditure for five years has been, in establishment and contingencies, Rs. 1,190 per annum, and Rs. 1,860 have been spent on forest roads."

Register of rights.

129. The entries in the Register of the Pilibhít Forest, drawn up by Mr. W. Lambe, Assistant Collector, in 1876, are as follows:—

"*Rights of Government and third parties.*—In the Pilibhít Forest all rights belong to Government, except that the villagers of Máhof enjoy the privilege of using the grass, wood, &c., from the forest for their own consumption, and grazing dues are also not taken from them or from the inhabitants of Barachanda.

"*Rights of way.*—There is no authorized right of way, except on the Pilibhít and Mádho Tánda road."

Condition and protection.

130. It is not easy to explain how this belt of forest remained unoccupied by cultivation, except that the soil in many parts is poor and sandy, and that the vicinity of the Mála, a sluggish stream running through a broad and swampy belt of low ground, renders the country in its immediate vicinity very unhealthy. The northern portion of this forest, adjoining the Tarái District, has been protected against fire during the hot season of 1880. Portions of the protected area have good soil, and will doubtless repay the cost of fire-protection. The boundaries of the Pilibhít Forest are demarcated by a continuous ditch, 3 feet by 3 feet, which also runs along the Mála "serpentine" as far as the fire-protected block extends. There is also a ditch, 4 feet by 4 feet, along the Tarái boundary.

Communications in the forests of the Pilibhit District.

131. The system of lines and roads projected and partly made in the forests of the Pilibhít District has its starting point at the village of Máhof, on the north-western end of the Pilibhít Forest. From this point lines radiate in different directions; one of these lines approximately follows the western boundary at a distance varying from half-a-mile to three miles from village land, and extends to the southern edge of the forest. One line runs due east to Maina Kót, and is continued from there till it joins the line which forms the through communication with Bhira.

The Pilibhít fire-protected block is bounded on the east side by the Mála "serpentine," a winding road skirting the Mála swamp. The road which will give through communication from Máhof to Bhira runs more or less along the western boundary of the Púranpur Forests, and it is intended to substitute a system of straight lines for the present meandering cart-roads which connect the villages on either side of this belt. Eventually it is proposed to build a double-storied forest-house at Maina Kót, and eight single-storied rest-houses in different parts of the forest are in course of construction or completed, with wells at each; and, besides these, there are eight good masonry wells in the forests.

* Some deserted village land has since been added, and the area is now 29,434 acres.

Financial results, Pilibhit District.

132. The financial results have been as follows :—

Revenue.

Items.	1879-80.	1880-81.
	Rs. A. P.	Rs. A. P.
Charcoal	2,421 4 3	2,078 9 0
Firewood	2,682 3 9	2,185 4 6
Poles and other wood	1,039 4 2	1,488 4 6
Grazing	857 1 9	720 11 5
Grass for thatching	40 0 0	67 2 0
Baib	94 6 3	324 5 0
Other items	1,581 14 8	2,160 2 3
Total ...	8,716 2 10	9,024 6 8

Expenditure.

Items.	1879-80.	1880-81.
	Rs. A. P.	Rs. A. P.
Revenue collection	1,636 12 11	1,817 6 11
Live and dead stock	383 5 11	905 0 7
Communications and buildings	3,059 0 6	7,106 5 9
Boundaries, fire-protection, and works of improvement, &c. ...	1,692 1 3	1,941 2 3
Establishment	1,404 6 5	3,177 0 4
Total ...	8,175 11 0	14,946 15 10

Most of the produce is removed from these forests on payment by means of permits, which are issued by the Ranger, Forester, or Forest Guard. I recommend for consideration, in the case of this as well as other forests in Oudh, whether it would not be expedient to adopt the system, which prevails in most districts of the Central Provinces, of using permits of different shapes and colours, each kind designating a certain quantity of forest produce and its money value. On such tickets nothing is required to be entered in writing except the date of issue.

Establishment.

133. The only permanent Forest Establishment sanctioned for the Pilibhít Forests is a clerk on Rs. 25, a munshi on Rs. 14, and three peons at Rs. 4 each (Rs. 12), and, besides these, the services of an Apprentice on Rs. 40 per mensem have been placed at the disposal of the Divisional Officer. The local protective establishment, consisting of 2 Foresters and 13 Forest Guards, is entertained as a temporary establishment. This is not as it ought to be, and a suitable permanent protective establishment should be provided for these forests. This, I understand, can be managed by effecting reductions in the protective establishment of the Gorakhpur Forests.

MAP
of the
RESERVED AND PROTECTED FORESTS
in
DISTRICTS
KUMAUN GARHWÁL AND TARÁI
of the
KUMAUN DIVISION
Scale 4 Miles=1 Inch
REFERENCE
Forest value boundary
Forest range do.
Do. block do.
Division do.
Area reclaimed from Jun
Protected Forests and areas open to the exercise of rights
Heights above sea level
Abbreviations G. Gaph, S. for S. Spur, N. Nadi or Nala
GANGES
GARHWAL
KUMAUN
BIJNOR
MORADABAD
RAMPUR
BAREILLY
TARAI
NAINITAL
Compiled during 1881, in the Office of the Superintendent of Forest Surveys, from maps by the S. T. and Forest Surveys &c.
Drawn by Tulsi Ram, October 1881
Photo-lithographed at the Office of the Superintendent, Survey of India, Dehra Dun, October 1881.

CHAPTER VI.

SUBMONTANE FORESTS IN KUMAUN.

134. The two great sub-divisions of the Kumaun forest belt, the Eastern and Western Divisions, are separated by the forests which are generally known under the name of the Kumaun Iron Company's Grant. All the timber extracted from Western Kumaun is brought to Rámnagar, except that from the Garhi Bulchand Forest below the foot of the hills, and from the outer hills west of Rámnagar. In the eastern forests, that portion which is situated between the Iron Company's Grant and the water-shed between the Sukhi and Nindhaur streams, is required to supply the timber (200 trees a year) to which the Nawab of Rámpur is entitled. The timber from the remaining forests of Eastern Kumaun finds its way chiefly to Pilibhít and Bareilly.

Three Working Circles to be established.

135. There is a demand for bamboos and woods of other kinds from the Kumaun Forests, but the only species the cutting of which requires to be regulated by a working-plan is sál. And for the purpose of regulating the cutting of this timber on a large scale, it will be convenient to consider the forests in the outer hills of Western Kumaun, which send most of their timber to Rámnagar, as forming one working circle; while in Eastern Kumaun, after excluding the forests required to supply the Nawab of Rámpur, it will be convenient for the present to establish two working circles—one comprising the hills drained by the Nindhaur and Kalauni and smaller streams between the Nindhaur and Sárda Rivers, and the other the forests outside the hills.

It will be understood that the limits of these three working circles cannot be very sharply defined, and that the whole arrangement must be regarded as purely temporary, the object being to regulate the cuttings to be made during the next few years.

East Kumaun. Valuation Survey of the Nindhaur Forests.

136. A detailed valuation survey of the forests on the hills drained by the Nindhaur River was commenced in January 1881, and the following is a summary of the results obtained.

The survey has only been completed in the lower or western part of the valley as far as Aonla Khera. This portion has been divided into eleven blocks, two of which, for reasons which will be explained further on, will be excluded from the valuation. It has also been decided to exclude the upper slopes on the north side of the valley, which are burdened with the rights exercised by the adjoining villages, as well as a large tract of bare slopes below the Lobchula Peak.

Summary of Valuation Surveys.

Blocks.		Area, in acres.	Sal trees in girth	
Serial Numbers.	Names.		Above 6 feet.	Between 4 feet 6 inches and 6 feet.
I.	Sunkheri	1,018	Not valued.	Not valued.
II.	Balot, South	1,068	1,115	2,792
III.	Balot, North	1,917	1,071	2,469
IV.	Ráta Ráu	811	866	2,149
V.	Khonáni, North	1,511	2,074	4,360
VI.	Bhalsáni	1,265	1,613	4,139
VII.	Aonla Khera, North	1,690	2,523	5,272
VIII.	Maswári	3,200	Not valued.	Not valued.
IX.	Siláni	1,810	3,048	6,347
X.	Khonáni, South	1,532	3,450	6,882
XI.	Aonla Khera, South	1,485	2,812	5,041
	Total ...	17,307	18,572	39,451
	Deduct areas not valued	4,218	.....	.....
	Area valued	13,089	.....	.....

Method followed.

137. The valuation has been made by dividing the area into plots according to natural features, chiefly ridges. Eighty-three plots have been formed in the total area of 13,089 acres, so that each plot averages about 157 acres.

The examination has been effected in the following manner. Nine survey parties are employed, each consisting of one recorder and four measurers. The party proceeds from the river to the upper limit of the plot along one boundary, the boundary trees having been marked. Each measurer is provided with an axe, with which he marks each tree measured by him on the bark, and a diameter gauge, on which the diameters of the different classes are indicated by colours. The size classes used are as follows:—

Diameter of	24	inches	and	upwards	...	...	Green.
„	18	„	to	24 inches	...	...	Yellow.
„	12	„	„	18 „	...	...	Black.
„	6	„	„	12 „	...	...	Red.

The measurers call out the colour of each class, which is noted by the recorder according to the system of notation used by Forest Officers in France. Besides sál, sáj (*Terminalia tomentosa*) and chír (*Pinus longifolia*) are measured and noted separately.

This system, which has been developed by Mr. E. P. Dansey, Assistant Conservator of Forests, on the ground of his experience in Jaunsár and in the Pátli Dún, appears to answer very well. The only point I have to suggest is that the trees along the boundary of adjoining plots should be marked in a conspicuous manner with white paint.

Work how checked.

138. The work of the parties is checked in the following manner. The counting of the plot selected for check is repeated by the party which had been engaged on its survey, under the personal superintendence of the officer responsible for the survey, who is expected to complete the counting himself. In the time from the 20th January to the 31st March 1881, 13,089 acres were surveyed, being at the rate of about 20 acres per party per day, inclusive of Sundays and other holidays and several rainy days, on which no work was done.

Rate of growth of Sal unknown.

139. This valuation survey furnishes a portion of the data required for framing a working-plan. Regarding the rate of growth of sál in this and other forests, we are as yet in complete ignorance, all attempts to determine the age of the sál tree by counting the annual rings in the wood having failed.

Under these circumstances, it will be necessary to establish a system of periodical measurements of sál trees of different sizes, and for this purpose two sample plots of half-an-acre each have been selected in the Chorgalia Forest, outside the Nindhaur Valley. These measurements, if steadily continued for five years, ought to furnish the requisite information, with such approximation as is necessary for present purposes. Meanwhile no more can be attempted than to establish a regular order of cuttings, and to agree upon the principles which should be followed in the selection of the trees to be cut, the chief aim being to promote as much as possible the development of the young growth of sál.

Quantity cut annually ought to be considerably less than the possible yield of the forest.

140. This plan must, as a matter of course, be so arranged that the quantity to be felled during this period shall remain considerably below the quantity which the forest is capable of yielding if treated according to correct principles.

It is considered desirable, in order to keep the market sufficiently supplied with timber from this source, that about 50,000 cubic feet of sál timber per annum should be extracted from the Nindhaur Forests; and it will be shown, in the following remarks, that this quantity is considerably below the possible yield of these forests.

General results of Valuation Survey.

141. As already explained, the valuation survey has only extended over a small portion of the valley, and hence we have nothing but the area to guide us in forming an estimate of the quantity of timber which the entire forest is capable of yielding annually. The forests which I am disposed to advocate should be included within the Nindhaur Hills Working Circle, may be estimated to measure 300 square miles, of which probably one-half, or 96,000 acres, may be regarded as workable sál forest.

As stated above, the valuation survey of nine blocks, aggregating 13,089 acres, in the lower part of the Nindhaur Valley, has given the following results :—

First class trees, above 6 feet in girth	18,572
Second class trees, from 4 feet 6 inches to 6 feet in girth ...	39,451

And, considering what is known regarding the extent and character of the forests in the hills between the Nindhaur Valley on the west and the Sárda River on the east, the available material in the Nindhaur Hills Working Circle may be estimated as follows :—

First class trees, above 6 feet in girth	60,000*
Second class trees, from 4 feet 6 inches to 6 feet in girth ...	120,000

The first class trees that will be felled in these hills may be expected to yield 40 cubic feet of timber each, and it will therefore be necessary to cut 1,250 trees annually, in order to obtain 50,000 cubic feet of timber. These, it should be remembered, must all be sound trees, because, in a forest freshly taken in hand like the Nindhaur, in which a new system of roads must be made and all arrangements for working are new, it will be expedient at first to confine operations chiefly to the extraction of sound timber. Nothing very definite can be said regarding the number of trees that should be felled annually, as there will be a good many trees of the second class which have attained maturity, and which should be felled together with the first class trees. So much, however, may be regarded as probable, that, at the rate of 50,000 cubic feet a year, the material at present in the forest will furnish an equal annual yield during a very long period, which will be more than sufficient to bring up the requisite number of trees of the smaller classes to first class size. Hence we are justified in assuming that the hill forests between the Nindhaur and Sárda Rivers can yield 50,000 cubic feet of timber annually, and this limit it will be convenient to fix for the cuttings of the next five years.

Proposals submitted.

142. I now proceed to submit proposals—*first*, regarding the order of the cuttings during the next five years; *second*, regarding the principles which should guide the selection of the trees; *third*, regarding the measures which should be taken to protect the forest from fire; and *fourth*, regarding the continuation of the valuation survey commenced.

Regarding the first point, it seems expedient to confine cuttings during this period to the lower part of the valley, as far as it is free of rights and has not yet been worked.

Of *Sunkheri*, the outer block on the right bank, that portion which adjoins the river is rocky and precipitous; and although the back portion is stocked with good forest, we do not propose to include it in the area to be worked during the next five years.

The *Maswari* block, on the left bank, is excluded because it is open to pasture and cannot at present be protected from fire.

The two blocks on both sides of the *Balot* River have been worked in former years, and should also be put back for the present if possible.

The *Ráta Ráu* block would require a separate road up the valley, and may also be excluded for the present.

* Such estimates, it must be understood, have no value in themselves, but, in the absence of definite data, assumptions must be made.

Blocks in which cuttings should be made.

143. The block assigned for the cuttings of the first year, 1882-83, is the *Siláni* block, on the left bank above the great bend of the river, containing 1,810 acres with 3,048 first class trees. Making allowance for the proportion of unsound trees and of trees that must be left standing on the ground, it is probable that this block will be found more than sufficient to furnish one year's supply. The protection from fire of this block should be taken in hand at once. The forest has mostly a northerly aspect, and is moist and shady, and fire-protection will probably not be found difficult.

After completing operations in this block, that on the opposite side of the river, called *Khonáni North*, and the adjoining block of *Bhalsáni* may be taken in hand. These two blocks aggregate 2,776 acres, with 3,687 first class trees. The upper part of Bhalsáni will be very difficult to work, the stream draining the larger portion of it passing through a long narrow gorge, with precipitous sides and water-falls. It is possible that a road could be made opening up this block from the east; but it is for consideration whether, on account of these difficulties, felling in this block ought not to be postponed.

After completing the work thus far, the block called *Khonáni South*, on the left bank, should be taken in hand, measuring 1,532 acres, with 3,450 first class trees; and subsequently the two blocks, *Aonla Khera North*, 1,690 acres with 2,523 trees, and *Aonla Khera South*, 1,485 acres with 2,812 trees.

These six blocks contain a total of 15,520 trees of the first class, and they should be sufficient to furnish the supply of five years at the rate of 1,250 trees per annum. In case it should be found necessary to exclude Bhalsáni, or otherwise to change the plan here sketched, it may become necessary to commence fellings either in the Balot Valley or in the Ráta Ráu block. But it should be clearly understood that, as far as practicable, cuttings in one block should be completed before work in a fresh block is commenced.

As the cuttings proceed, so the area protected against fire should be extended; and it should be distinctly understood that the boundaries of the blocks may be modified as the work progresses, so as to fit in best with the arrangements for the working of the forest and for protecting it from fire.

Principles which should guide the selection of trees.

144. The next point to consider is the selection of the trees to be cut. The remarks in this respect relate only to the lower part of the forest here adverted to, and do not refer to the extensive tracts in the upper Nindhaur Valley, which, to a great extent, are stocked with chír.

At the outset, it will be convenient to distinguish between those slopes which have a northerly and those which have a southerly aspect. The slopes with a northerly aspect are mostly moist and shady, so much so as to affect injuriously the growth of young sál. In a plot, numbered 47 and extending from the river half way up the ridge, which I examined on the 7th March, I found a large number of seedlings of sál, with last rains' leaves and the whole shoot above ground killed, not by frost or other injury, but apparently by an excess of moisture. It is probable that these plants will shoot up again, and that eventually they will grow into seedlings; but the general appearance of young sál on that slope showed that the conditions for the natural reproduction of that tree were much less favourable than on the warmer and drier slopes with a northerly aspect. Young shoots of sál which had suffered in a similar manner were noticed by me on a moist northerly slope in one of the valleys of the North Pátli Dún Hills. As a matter of fact, seedlings in the Nindhaur Valley are, as a rule, much more numerous on the southerly than on the northerly aspects, and this consideration must be carefully taken into account in arranging fellings. As soon as fire-protection has been firmly established in this forest, the slopes with northerly aspect would greatly benefit by the removal of other trees in addition to the sál trees, so as to diminish the shade. If this cannot be done, sál must be cut more cautiously than on the warmer and drier slopes with a southerly aspect.

With this reservation, I am of opinion that all marketable trees above 6 feet in girth, and a proportion of the smaller trees which have attained maturity, may be cut, with the following exceptions:—trees standing on narrow

spurs and ridges and on precipitous slopes should be spared; also sál trees standing isolated near blanks, or in a forest of other trees and bamboos. Where the ground is already stocked with young growth, it will be understood that trees may be cut much more freely than where this is not the case.

Fire conservancy.

145. As regards fire-protection, it will suffice to say that the needful measures should be taken at once to keep out fires from the six blocks assigned for the cuttings of the next five years. On this condition alone will it be advisable to make the cuttings here proposed. Had fires been excluded from these blocks at an earlier date, the satisfactory regeneration of the areas on which cuttings will be made might be depended upon with certainty, and it would be possible to cut a much larger proportion of the marketable trees.

Continuation of Valuation Surveys.

146. The last point to be considered in this respect is the continuation of the valuation surveys. As soon as the detailed topographical survey of this forest has been completed, these valuation surveys should, provided officers and men are available, be extended to the more important blocks which contain sál forest in the Nindhaur Hills Working Circle. There are, however, large areas which are open to grazing and which cannot be protected against fire, mostly along the northern boundary of the forest, of which it would be waste of time to make any valuation surveys. It is also doubtful whether it will be necessary to make a complete valuation survey of the outer or southern slopes of the hills, and of that part of the Nindhaur Forest which is chiefly stocked with chir. We must not overdo these valuation surveys, or extend them to areas stocked with forest which is not likely to require cutting in the immediate future.

In many cases it will probably be found sufficient to examine each block or compartment and to draw up a brief descriptive account of it, indicating the principal features in the growing stock and otherwise, as far as they affect the working of the forests.

Forests outside the hills.

147. So far regarding the Nindhaur Hills Working Circle. The forests outside the hills consist of the following great blocks:—

I.—The *Horái* block, about 6,000 acres, south-west of Chorgalia, on nearly level ground, and on both sides of the Sitarganj-Haldwáni road. The fire-protection of the portion north-east of this road has been attempted with varying success since 1877. A great part of this forest is covered with high grass and scattered groups of poles, and a few large hollow trees. Successful fire-protection will change the character of this forest, and, until this has been accomplished, no trees of any kind should be cut in it. The forest extends to the boundary of the Tarái District, but the southern part, near the Tarái boundary, is not at present under the control of the Forest Department. Here the ground is undulating, with numerous streams and springs, and the growth of sál in this portion which has been excluded from the reserve is excellent.

II.—The *Chorgalia* block, about 2,000 acres on level ground, partly above, partly below, a high bank. This is an almost pure forest of sál poles and young trees, and is in many parts completely stocked. It is grazed over and burnt every year, but, as there is scarcely any grass, the fires do very little harm. Nevertheless, I am of opinion that the ground will improve considerably by fire-protection, and I would therefore recommend that the eastern portion, which is well stocked, should be closed entirely. It will be instructive to watch the effect of closing on both portions, above and below the bank. The sub-soil in the portion below the high bank is probably inferior. On both the upper and lower portions, half-acre

sample plots have been marked off, on which all trees should be measured periodically twice a year—once in the beginning of December and once in the beginning of May. In the Chorgalia Forest I do not recommend that any cuttings should be made at present. It is possible that when fire-protection has been firmly established, thinnings may be made, but this operation had better be deferred for the present.

III to VI.—A large extent of forest between the Dewa (Nindhaur) and Kalauni Rivers and below the foot of the hills. The whole consists of four blocks. *First*, the western corner near Chorgalia, chiefly in branches and former beds of the Nindhaur and its feeders coming from the outer hills, stocked with great masses of khair and sissoo, mostly young, which are periodically swept away by the changes in the course of these streams. *Second*, further east, *Jaunlasál;* stretches of good forest of sál poles, alternating with open grass lands and extending to the Birgot Sot, which is called the Gumti River lower down, a portion of which was protected from fire during the hot season of 1880, attempts, partially successful, having been made since 1877. *Third*, the *Gangápur* Forest, a large extent of dry raviny ground extending to the Laibar River, and stocked with a mixed growth, in which sál predominates. *Fourth*, the *Lower Kalaunia*, a mixed forest with bamboos, but without sál, with a large area stocked with khair and sissoo near the Kalauni River. In this block, near the Tarái boundary, where water is plentiful, there are detached clumps of the thorny bamboo (*Bambusa arundinacea*).

East of the Kalauni are four more blocks as follows:—

VII.—The *Galiapáni* block, below the road and between the Kalauni and Chini Nadis; a little sál near the road, otherwise mixed forest with a large area of bamboos (*Bambusa arundinacea.*)

VIII.—The *Barmdeo* block, above the road extending from the Chini Nadi to Barmdeo. The greater part of this block is well stocked with sál poles, with khair and sissoo near the Káli Gadh.

IX.—The *Sárda* block, consisting of numerous islands in the Sárda River, extending over a length of eight miles; stocked with sissoo and khair in all stages of growth, which are periodically washed away by the floods of the river.

X.—The *Chandni* block, which is the upper end of the Bilheri Forest in the Tarái District, about 2,500 acres, the greater part well stocked with sál poles of great height and good growth. Of this block a small portion only has been notified as a reserved forest under the Act, and, according to information received lately, it is probable that the remainder will not be included within reserved forests.

It must be left for future consideration whether the north boundary of these blocks near the hills (II—VI and VIII) should run along the foot of the hills, or should not rather follow the line of water-shed of the outer range.

Cuttings in the forests outside the hills.

148. It seems desirable, and I understand it to be the wish of the local officers, that any timber which may be felled in these forests should be cut and exported by purchasers. Hitherto considerable quantities of timber have been sold to and exported by purchasers in the forests cleared for cultivation outside the reserved forests; and while at Pilibhít I examined a large private depôt, chiefly sál and haldu, near that town, which is almost entirely supplied by the timber thus extracted. As regards sál, this source is now coming to an end, but of other kinds there will still be a large supply.

For some time to come it will probably not be possible to cut any very large quantities of sál timber in the reserved forests outside the hills; and it should be distinctly understood that no trees must be cut in any block which is not protected against fire. But a commencement should be made in those blocks which have thus been protected, and where the young growth is sufficiently advanced to justify such cuttings. For this purpose I suggest that the ten forest blocks here enumerated should each be divided into suitable compartments, and that one compartment a year be taken in hand, the sál trees to be cut being marked by a responsible officer. I would recommend that the division of these blocks into compartments be made by an Officer of the Working-Plans Branch in consultation with the Divisional Officer, and that at the same time a summary descriptive account of each compartment be drawn up, indicating the treatment which it requires and the extent to which cuttings may be made in it.

West Kumaun.

149. The Western Kumaun Forests consist of the following ranges :—

(1) *Garhi Bulchand:* area 10,937 acres; outside the hills, near the Garhwál boundary; partly on level, partly on undulating ground; stocked with good forest of sál poles, except on stretches of dry and high ground and where the forest is open. The area is divided into ten compartments, and a great part of it has been partially protected against fire since 1876, though the greater part was burnt in 1878.

(2) *Chilkia* Forest: comprising the hills between the Rámganga and Kosi Rivers, east of the Garhwál District boundary; area 80,467 acres.

(3) *West Kotah* Forest: bounded by the Kosi River, the foot of the hills, and the Iron Company's Grant; area 35,200 acres.

Blocks of the Chilkia and West Kotah Forests protected from fire.

150. The following remarks will chiefly refer to that portion of the Chilkia and West Kotah Forests which is protected against fire. This area has been divided into six blocks, which are as follows :—

Chilkia Forest.

	Acres.
I.—Mohán Block	7,489
II.—Dúngalgarh „	10,400
III.—Dúlwa „	15,710
IV.—Meláni „	15,543
Total ...	49,142

The Mohan and Dúngalgarh blocks are separated by the main road from Mohán to Chaknakal, which follows the valleys of the Sasnah and Timlapani, which come down from the water-shed at Durgadeh. The Dúngalgarh and Dúlwa blocks are separated by the Dangari and Sangri streams, which flow down from the water-shed at Sultánchaor. The Dúlwa and Meláni blocks are separated by the range which runs from Barsoti to the Kosi at Dhekuli.

West Kotah Forest.

	Acres.
I.—Kosi Block	13,066
II.—Sitabani „	20,485
Total ..	33,551

These are separated by the Kotalia Sot, a branch of the Bándarpani. Of the above area, two compartments in the Sitabani block, aggregating 3,020 acres, are not protected against fire.

The Chilkia and Kotah Forests have been divided into 65 and 37 compartments respectively, total 102; the smallest measuring 288 acres and the largest 1,592 acres, the average area being 811 acres. The boundaries between compartments are formed either by prominent geographical features, or by paths, or by fire-lines.

Portions of these forests were protected before 1875, but in the hot season of 1874 they were mostly burnt. Since 1875, however, the success has been very good. In that year the whole area was not taken in hand at once, but the work was extended gradually, and it is now in excellent order, so that the protection of the whole of this area may be confidently expected.

Method followed in fire-protection.

151. The plan followed by Major J. E. Campbell, the Divisional Officer, and which has gradually been developed by actual experience, is to maintain a system of cleared fire-lines, along which run foot-paths practicable for walking and in most cases for riding. These forests are all on hilly and exceedingly broken ground, the highest point being Dúngalgarh, with an elevation of 3,500 feet; while the lowest point is on the Kosi River, above Rámnagar, at about 1,200 feet. Hence it is clear that straight lines are not possible, and that special arrangements are required to make these fire-lines accessible. The plan developed with great success by Major Campbell is to establish a net-work of paths, three to four feet wide, which are built up with dry walls where necessary. Along these paths lines, generally 50 feet wide, are cleared by completely cutting all trees, and these lines are burnt every year. Some of the main lines, such as that along the Dúlwa Range, are 100 feet wide.

Since the system has been in force in a perfect manner very few important fires have occurred, and meanwhile the young growth of sál and other trees has, where the circumstances were otherwise favourable, made such wonderful progress that, unless any unusual accident occurs, the protection of the forest may be regarded as assured.

Beneficial effect of fire-protection.

152. The change for the better in the condition of these forests, as compared with their condition on my two previous visits in 1863 and 1875, is most remarkable and exceedingly satisfactory. On my visit in April 1863 the whole of the forest was covered with the ashes of burnt grass, and with the leaves, tops, and branches of the trees felled. Heavy cuttings had been made in many places previous to my visit, and here trees felled and timber which had not been removed, as well as dry trees, were burning or smouldering. The whole place was black and desolate, and no trace of young growth was to be seen. In 1875 some improvement had taken place, because fellings had been carried on more cautiously, but nevertheless reproduction was scanty. On my present visit every thing was green; and, instead of heavy grass under the trees, the ground in many cases was covered with thickets of young growth, with a large proportion of sál.

One great advantage of continued fire conservancy in these forests has been that it has made the continuance of protection easier, and after a few years more it is probable that the risk from fires will be greatly diminished.

Timber cut since 1868-69.

153. The following statements give an abstract of the timber extracted from the Chilkia and West Kotah Forests during the last thirteen years, *i. e.*, since 1868-69 :—

Chilkia Forest.

YEAR.	NUMBER OF TREES.	CUBIC CONTENTS IN CUBIC FEET				AVERAGE CONTENTS PER TREE.
		Of Logs.	Of Scantlings cut by		Total.	
			Government.	Merchants.		
						Cubic feet.
1868-69	...	...	...	...	...	...
1869-70	...	...	...	...	...	...
1870-71	....	...	...	...	...	...
1871-72	3,140	128,000	...	...	128,000	40
1872-73	3,895	...	67,372	...	67,372	17
1873-74	...	...	...	...	...	...
1874-75	6,082	16,840	98,372	...	115,212	19
1875-76	915	23,200	7,755	...	30,955	34
1876-77	...	...	...	...	...	...
1877-78	2,500	20,000	35,310	...	55,310	22
1878-79	2,318	6,000	15,207	681	21,888	9
1879-80	2,469	...	21,993	6,340	28,333	11
1880-81	3,760	...	30,525	9,684	40,209	10
Total ...	25,079	194,040	276,534	16,705	487,279	19
Average per annum for 13 years ...	1,929	14,926	21,272	1,285	37,483	...

West Kotah Forest.

YEAR.	NUMBER OF TREES.	CUBIC CONTENTS IN CUBIC FEET				AVERAGE CONTENTS PER TREE.
		Of Logs.	Of Scantlings cut by		Total.	
			Government.	Merchants.		
						Cubic feet.
1868-69	522	23,720	...	...	23,720	45
1869-70	...	...	...	...	...	...
1870-71	...	...	...	...	...	...
1871-72	1,889	...	28,775	...	28,775	15
1872-73	3,464	...	83,316	...	83,316	24
1873-74	996	...	18,245	...	18,245	18
1874-75	...	...	...	...	...	...
1875-76	...	...	...	...	...	...
1876-77	32	...	2,362	...	2,362	74
1877-78	290	13,062	379	...	13,441	46
1878-79	...	...	...	...	...	...
1879-80	647	6,225	2,512	...	8,737	13
1880-81	340	17,862	...	...	17,862	52
Total ...	8,180	60,869	135,589	...	196,458	24
Average per annum for 13 years ...	629	4,682	10,430	...	15,112	...

These statements were prepared for me by the Divisional Officer, and I am informed that the figures may be regarded as correct, except that in some cases it is probable that a smaller number of trees than that stated were cut. It will be noticed that in the Chilkia Forest 25,079 trees, containing 487,279 cubic feet of timber, were cut during this period; while the West Kotah Forest yielded 8,180 trees, containing 196,458 cubic feet of timber. The average annual outturn during this period will be seen from the following figures :—

Forest.	Number of trees.	Cubic feet of timber.
Chilkia	1,929	37,483
West Kotah	629	15,112
Total ...	2,558	52,595

Outturn in cubic feet per tree.

154. It will also be noticed that the timber was brought out partly in log, partly in scantling. In those years in which logs only were cut, the cubic contents of the trees were generally largest. Thus in 1880-81, in West Kotah, the trees averaged 52 cubic feet, and in 1871-72, in Chilkia, they averaged 40 cubic feet.

The scantlings exported from these forests are chiefly karris, from 6 to 15 feet long and from 4 by 4 to 5 by 6 inches. The practice is generally that the better trees are cut up on Government account, and of late years it has been found expedient, after the Government operations had been completed, to allow purchasers to cut up the trees previously marked, but not found sufficiently good to be cut up and brought to depôt on Government account. It will be noticed that in those years when timber was chiefly cut up into scantlings, the outturn was very small; thus the yield per tree from 1878-79 to 1880-81 in the Chilkia Forest was only 10 cubic feet.

It should, however, be mentioned that, besides the outturn per tree shown in these statements, a great deal of the refuse timber, which is not exported at the time, is subsequently utilized and exported as dry timber by purchasers. Hence the outturn per tree given in the preceding statements is less than it actually has been.

Localities where fellings were made.

155. In the Chilkia Forest the chief fellings during this period were made—

(I.)—In the forests situated on the water-shed between the Timlapani and the Paniali streams, the chief of which is the Durgadeh Forest—

	Trees.
1871-72	3,140
1872-73	3,800
1880-81	3,054
Total ...	9,994

(II.)—On the left bank of the Rámganga, below the mouth of the Timlapani Sot—

		Trees.
1872-73	... ...	95
1874-75	... ...	400
1875-76	... ...	540
1878-79	... ...	42
	Total ...	1,077

(III.)—On both sides of the Rámganga, near the Marchula bridge—

		Trees.
1874-75	... ...	563
1875-76	... ...	375
1877-78	... ...	2,500
1878-79	... ...	481
	Total ...	3,919

(IV.)—On the flats on the right bank of the Kosi River, below the Dangari Sot—

		Trees.
1878-79	... ...	1,775
1879-80	... ...	2,469
1880-81	... ...	706
	Total ...	4,950

(V.)—At the head-waters of the Ratapani Sot, a stream running southwards from the Dúlwa Range through the Meláni block—

1874-75 ... ... 2,900 trees.

In the West Kotah Forest the fellings have all been on the hills in the bend of the Kosi River, in what we call the Kosi block, with the exception of the Duli Sot, in the northern part of the Sitabani block, where 680 trees were cut in 1878-79 and 1879-80.

Most cuttings were made in forest not previously touched.

156. All these cuttings were in forest not previously touched, except the fellings of 1880-81, in the Durgadeh Forest, and those of 1878-79, 1879-80, and 1880-81, in the flats on the lower part of the Kosi River. The Durgadeh Forest was an untouched forest in 1863, well stocked with magnificent trees. It was cut heavily from 1870 to 1873, and it has been found possible to make a second cutting this year. In the forests on the flats near the Kosi River the first cutting was made many years ago, and the second cuttings made there during the last few years were justified by the fact that the ground is well stocked with young growth of saplings and poles of sál.

No forest is now left in West Kumaun which has not been felled previously, nor is there any area which contains sufficient timber to justify Government timber operations on a scale similar to those hitherto undertaken. But in most of the forests visited by me on the present occasion it will be possible, without in any way endangering reproduction, to make a

second cutting, and some such second cutting will greatly benefit the development of the young growth. It will, however, be necessary to arrange these second cuttings in a very methodical manner, and always to keep in mind that the chief aim must be to secure the regeneration of the forest by means of a complete growth of young sál.

Ramnagar the chief outlet.

157. All the timber exported from Western Kumaun is brought to and sold at Rámnagar. I am not of course here speaking of the dry timber brought out by purchasers, which finds its way to many places in the plains, but of the green sál trees marked for felling. Rámnagar is an old outlet for the timber of these forests. Government have an excellent depôt there, and a large timber shed for the storage of scantlings. Merchants from Meerut, and even from the Punjab, come to Rámnagar to purchase this timber, and it is most desirable that the importance of the place as a timber depôt should be maintained. After fully discussing the subject with the local officers, we have come to the conclusion that, in order to secure this object, it will suffice for the present to bring to Rámnagar annually 30,000 cubic feet of timber. The total area of the forests protected from fire is, as already stated, nearly 80,000 acres. The only block in which there is a considerable extent of forest without sál is the Meláni block, outside the Dúlwa Range. Making allowance for this, the total area of sál-producing forest may be estimated to cover 70,000 acres; and considering that the greater part of this area is well stocked, either with young growth, or with saplings under 18 inches in girth, or with poles from 18 inches to 4 feet 6 inches, or with young trees between 4 feet 6 inches and 6 feet, and that it contains a large number of trees of more than 6 feet in girth, an annual yield of 30,000 cubic feet is an extremely small quantity, which, if it were necessary, might be increased ten-fold without any injury to the forest.

However, it is better, until the forest may be regarded as absolutely safe against fire, to keep on the safe side and to cut sparingly, leaving it open to increase the cuttings largely in case any necessity for doing so should arise.

Plan of cuttings.

158. No useful object would be gained by making a valuation survey of these forests, such as has been made and is proposed to be made for forests which contain large quantities of mature timber, and hence the cuttings in these forests should be regulated by area and not by quantity. As already stated, the forests have been divided into 102 compartments, two of which are not included in the protected area, the average size of these compartments being 811 acres. There are also 19 compartments in the Meláni block, which, although they contain large areas well stocked with excellent sál poles, have not sufficient large timber in them to justify their inclusion in the present arrangement. There thus remain 81 compartments in the other blocks, and the plan which I propose for adoption is that two compartments be assigned to the operations of each year, with the provision that, should it be desirable in any one year to cut a larger quantity than the two compartments selected will furnish, the cuttings may be extended to three compartments. If this suggestion is adopted, the cuttings now proposed to be made will extend over a period of from thirty to forty years. These cuttings should proceed in regular order, and, as far as such may be feasible, the work in one of the six blocks should be completed before it is commenced in a second block. Whenever practicable, the compartments worked in successive seasons should be contiguous to each other.

Selection of trees to be cut.

159. It will now be necessary to define as far as possible the principles by which the selection of the trees to be cut should be governed.

Before entering upon this question, which in the present case is one of great difficulty, it will be useful briefly to note the main classes of forest which I have observed in this area. As already mentioned, I have had the advantage of

examining these forests on three successive occasions: in April 1863, when no protection had been attempted, when large fellings had been made over extensive areas, and when the annual fires were fed by great masses of tops, branches, and rejected timber which had been left on the ground after the fellings; I again visited the forests in February 1875, when they had for upwards of ten years been protected against indiscriminate cutting, and when some (though not very successful) attempts had been made to keep out fires. My present visit was the third, and on this occasion I have seen the beneficial effect of six years of more or less complete fire-protection. I am thus in a position, with the aid of the information given me by the local officers, to form some conclusions regarding their treatment.

Forests in which cuttings were made more than twenty years ago.

160. A very important class of forests is that in which heavy fellings were made more than twenty years ago, and which now consist of old trees, mostly hollow or otherwise of little value, left standing at the time that the cuttings were made, and young trees which have grown up out of the groups of saplings and poles which were on the ground at the time the forests were cut. In forests of this description the ground in 1875 was mostly covered with high grass, which has now to some extent given place to thickets of saplings. Forests of this description are found on the flats along the Kosi River and in other accessible parts of the forests, as well as on the plateau between the Kosi and the dún of West Kotah. In such forests young growth is found of all ages, from one year's seedlings to saplings and poles; older as a rule in the more accessible, and younger in the more remote, localities, according to the time when the cuttings took place. In forests of this description there are two classes of marketable trees—*first*, old trees, which were rejected at the former cutting, but which can be utilized by sawing the timber into scantling; *second*, young trees, which have attained maturity since the first cutting was made.

Where the ground is sufficiently stocked with young growth, there can be no doubt that all old and hollow trees should be cut out as far as they can be converted into money. As regards the younger trees, the advantage of allowing them to increase in size and value must be carefully weighed against the present profit to be realized by cutting them and the benefit to be expected for the young crop from their removal. Each forest plot must be treated on its own merits, and in cases of doubt the regard for the young crop should prevail over other considerations. In the flats on the right bank of the Kosi River cuttings similar to those here recommended have already been partially carried out, all marketable, old, and defective sál trees having been cut between 1878 and 1881.

Forests which have grown up on deserted fields and grazing grounds.

161. A class of forests different in their origin, and also, as a rule, in their constitution, are those which have sprung up at different times on deserted fields and grazing grounds. Such forests generally consist of dense masses of saplings or young poles, and in some cases the terraces of the old fields can still be distinguished. Instances are the forest on Rudra Chaor, a series of gentle slopes extending from Kuskundli to the Rámganga River at Chaknakal. Here a regular succession of ages exists on a considerable area, the young forest of saplings occupying the lower slopes, while the higher slopes are stocked with compact forests of poles. The pole forest of Amtanulla, above Mohán, belongs to the same class, but is older and the trees are larger; and east of it, on another flat, is a large extent of dense saplings, from 20 to 40 feet high and up to 15 inches in girth. The Durgadeh Forest had also originally sprung up on deserted fields, and in places the retaining walls of the old terraces are still visible. The same may be said of the dense forests of poles and stunted trees at the head of the Kotlia Sot, on the left bank of the Kosi River.

The forests of this class frequently contain mature trees of different ages, and, as before said, where the ground is well stocked with young growth, most of this may with advantage be cut. Some of the forests of this class have sprung up, not actually upon deserted fields, but on village grazing grounds. Thus, near the village of Leti and other villages at the edge of the West Kotah Forest, there are large areas of open sál forest, consisting of old, girdled, and stunted trees, the ground underneath being the favourite grazing ground of the village cattle, with a bare surface trodden down by the feet of the cattle, and with no undergrowth whatsoever. If the village to which such a forest belongs were suddenly thrown out of cultivation, and the forest left to itself, the latter would in course of time doubtless get stocked with dense masses of saplings, and the same would be the case with the extensive blanks in its vicinity.

Forests in which cuttings were made within the last twenty years.

162. A third, but not very extensive, class of forests are those in which fellings have taken place within the last twenty years, and where the young growth has not yet had time to cover the ground completely. An instance is the forest on the flats on the left bank of the Rámganga, near the Timlapani Sot, where fellings were made between 1872 and 1879. Here a luxuriant growth of small-sized trees—such as *Mallotus philippinensis* (rohni), *Tetranthera monopetala*, and *Phyllanthus nepalensis*—has taken possession of the ground. But sál is also coming up, and will doubtless get the upper hand. Similar forests may be seen all the way up the Timlapani Valley to Durgadeh, and this last named forest belongs to the same class.

Durgadeh Forest.

163. Regarding the Durgadeh Forest, the following is an extract from the notes embodying the results of my visit in February 1875 :—

"When I examined this forest in 1863, Durgadeh was a completely stocked forest of mature trees, with an average height in the better parts of 100 feet, and without any grass or underwood. Between 1869 and 1873 the greater part of the sound trees were cut, and its present appearance is that of a regularly, but incompletely, stocked forest of tall middle-aged trees. Many of the stems are bent and crooked, and there are other indications that the majority of the trees now on the ground are not in reality middle-aged trees, but are trees which have attained maturity, the remains of the old crop, and mostly those which were suppressed and bent aside by their more vigorous companions. The ground is covered with khajúr (*Phœnix farinifera*), and with grass and ganj (*Milletia*), but with very little young sál."

Up to that time the forest had been burnt annually, and this sufficiently accounts for the absence of sál seedlings in 1875. But since 1875 the forest has been protected from fire ; yet there is very little young growth of sál, and what there is consists almost entirely of one or two years' seedlings. Extensive fellings of defective trees, and of some fine and tall trees for bridges, have lately been made in this forest. It is possible that these cuttings will have a beneficial effect in stimulating young growth by giving more light. And indeed, in 1875, I stated in my notes that if the exclusion of fire should not within a few years increase the growth of young sál, then another cutting should be made so as to give more light.

The case is by no means clear, and it will be obvious that in this and similar instances, where the ground is not stocked with young growth, the greatest caution must be used in cutting. In the Durgadeh Forest, katbhiláwa *(Buchanania latifolia)* and sándan *(Ougeinia dalbergioides)* have sprung up in large numbers since the forest was first cut, and it is remarkable that in blanks also no sál has come up.

The variety of the conditions of soil, aspect, and elevation in the Chilkia and West Kotah Forests is so great, that it would be quite impossible to give an exhaustive account of all the different classes and descriptions of forest. The classes here described are mentioned merely by way of illustrating some of the more common features in these forests.

Cuttings must be most carefully regulated.

164. The cuttings here proposed to be made are selection fellings, which have the double object of utilising as much of the marketable timber now standing in the forest as possible and of promoting the growth of young sál.

In some of the compact forests of saplings and poles, successive cuttings by compartments or clearances in 100-foot lines may perhaps eventually be found to be the best plan of treatment. No cuttings are admissible except selection fellings, in the manner here suggested. Under these circumstances, it is obvious that the selection and marking of the trees to be cut must be done by intelligent and responsible officers, who must in each case judge for themselves.

One of the most remarkable features in the Chilkia Forest is the great increase in the number of bamboos which has taken place within the last ten years. There is now an underwood of bamboos under the sál in many parts of the forest, which promises to be of great value hereafter. This species of bamboo (*Dendrocalamus strictus*), as is well known, seeds sporadically. In the vicinity of Mohán large areas seeded in 1872 and 1873, and the young plants which then grew up from the seed are now nearly full grown.

Summary descriptive account of compartments.

165. In order to place the working of this forest on a satisfactory footing, I am disposed to suggest that the compartments be examined, at an early date, by an officer of the Working-Plans Branch, who should, with the aid of the local officers, draw up a brief and summary descriptive account of each.

The headings under which this descriptive account should be drawn up are those prescribed in the Forest Department Code. Special attention should be paid to the marketable trees which are fit for cutting, and to the effect which their cutting may be expected to have on the young growth of sál. The boundaries of these compartments may, if necessary, be modified, but upon the whole they seem to be well selected. They should be entered on a copy of the large scale map prepared by the Forest Survey, and copies of this map, without hill shading, reduced to half scale if necessary, and with the boundaries of blocks and compartments and the names and numbers of blocks and the numbers of compartments, should be printed for the convenient use of the local officers.

Record of cuttings.

166. It is essential that a complete and accurate record be kept of the cuttings made in each compartment. Besides the entries in the prescribed registers, I recommend in the present instance that for convenient reference the chief data be entered by hand on the compartment map, *viz.*, year of cutting, number of trees cut, cubic feet of timber extracted. It will be understood that these entries are only intended to show the cutting of green sál trees. The object of these entries is to make the information readily available for inspecting officers.

Timber how exported.

167. The cuttings here proposed will probably result in the extraction of considerable quantities of timber, which it may be worth while to export in log. Defective trees will as hitherto be cut up and brought to depôt in scantling. I was much pleased to see the present arrangements for the export of such timber, which briefly are as follows:—The trees are cut and sawn up by the sawyers working under contractors, who are paid at certain rates per score or hundred pieces, according to the class of scantling. The pieces are carried by buffaloes, two or four pieces (according to size) by one animal, to a convenient place on the Mohán-Rámnagar road, from whence they are carted to

Rámnagar. The people who undertake the carrying and the carting of the scantlings are generally Mussulmans from Káshipur or Moradabad. Separate contracts are made for the carting and for the dragging by buffaloes; and on rough and steep ground, if the scantlings have to be carried by men on to the road, a separate contract for this is made with people who come down from the hills for this work.

It is estimated that the payments made for the cutting and carriage of scantlings to Rámnagar aggregate 6 to 8 annas per cubic foot, while the amounts realized range from 8 annas to Re. 1-12 per cubic foot. Much better profits are generally made by the Forest Department on the extraction of timber in the shape of logs, the rates paid aggregating 8 to 12 annas, while the prices realized range from Re. 1 to Rs. 2-4 per cubic foot.

After the departmental operations, whether extraction of logs or of scantlings, have been completed, persons desiring to export timber are permitted to enter the forest, and they cut up and remove any trees previously marked, which were found not to be sufficiently good to justify extraction by Government agency. Purchasers are, as a rule, not allowed to enter the compartments for this purpose until after the completion of the forest operations, and it thus happens that the successive working of a compartment by Government and contractors extends over two or three seasons.

Works of improvement.

168. It now remains to say a few words regarding the work which has been commenced, and which is further required, for the general improvement of the forest. Creepers have been cut in the Garhi Bulchand Forest, outside at the foot of the hills; and trees of the less valuable kinds have been cut in a series of compartments on the right bank of the Kosi River, below the Dangari stream. These last named operations were commenced in 1878, and have since been continued annually. The following kinds were spared:—haldu (*Adina cordifolia*), jáman (*Eugenia Jambolana*), sain (*Terminalia tomentosa*), bákli (*Anogeissus latifolia*), dhaura (*Lagerstræmia parviflora*), dhamin (*Grewia vestita*), sándan (*Ougeinia dalbergioides*), amaltás (*Cassia Fistula*), gosham (*Schleichera trijuga*), genti (*Boehmeria rugulosa*), and harra (*Terminalia Chebula*). Mohwa (*Bassia latifolia*) was not spared. When these operations were first commenced, the trees taken out were not felled but girdled; but it was found that the girdling was insufficiently done and was difficult to control, so that the plan at present followed is to cut down the trees. In this operation it should be borne in mind that trees which habitually remain small—like *Phyllanthus Emblica*, *Tetranthera monopetala*, *Casearia*, *Antidesma*, *Grewia*, *Randia*, *Gardenia*—do not interfere in the least with the growth of sál, the latter going ahead of them and gradually suppressing them without any difficulty. Some of the trees which have been cut, such as the dhúdi (*Holarrhena dysenterica*), had perhaps better be spared. The wood of this and other allied trees is used largely for carving, and it is impossible to say whether it will not prove an important article of export. When trees of other kinds do not interfere with the healthy development of sál, their admixture is rather beneficial, as they will tend to counteract the development of caterpillars and other insects which are injurious to sál.

Other trees associated with Sal.

169. Upon the whole it must be said that in the West Kumaun Forests, as far as they are included within the fire-protected area, the trees of other kinds in sál forests are not very numerous, although there are large tracts of precipitous ground where bákli, sain, and dhaura prevail; and on stiff soil, especially near the bottom of valleys, there is a large proportion of sain. In the Meláni block also there is a large extent of mixed forest with little sál. But, speaking broadly, the cases are not numerous in which other trees are likely to interfere with the development of young sál, the chief exception being katbhiláwa (*Buchanania latifolia*), which is gregarious

and often covers large extents of ground to the detriment of sál. Yet, in the flats west of the Kosi, where this operation has been carried on, its effect upon the growth of sál will be beneficial, provided fire-protection continues to be successful in the areas in which these improvement cuttings have been made. There is no doubt, however, that the large mass of dry wood on the ground, which is the result of this operation, greatly increases the risk from fire. I would strongly urge, therefore, that in these compartments additional precautions be taken to guard against the inroads of fires, which, if admitted, would at the present time be extremely destructive. Fortunately, most of these woods will decay rapidly, but until the great* mass of the wood now lying on the ground in these compartments has disappeared, I do not recommend the resumption of these operations, except in special cases simultaneously with the timber operations here proposed. The fact is that although the effect of these operations will doubtless be beneficial, yet they are not so urgent as to justify the increased risk from fire which they entail.

Plantations.

170. Experimental sowings of sál and other trees have been made on blanks stocked with grass in West Kotah. The plan pursued is to plough and sow a crop of grain, and, after cutting the crop, to plough in lines 15 feet apart, throwing up ridges along the lines. Unfortunately, the supply of sál seed was deficient in 1879 and 1880, so that the ridges were only sparingly sown and to a great extent with seed of other kinds. The result is that the plants in the lines are scattered, and it has been necessary to protect them with hoods of grass against frost and the sun of the hot season. The sowing in lines is correct, but in a case like the present I would strongly urge that along the lines a belt at least 12 to 18 inches wide be sown thickly with sál. It must be remembered that of the seed thus sown a small portion only survives, and the closer the young plants stand in the belts the more will they be able to protect each other.

The planting of Sal on a large scale not called for.

171. In a forest like Western Kumaun, where sál thrives so vigorously and where there is so large an area of sál forest, there is no necessity for sowing the tree artificially on a large scale. As an experiment, and with the view of improving our knowledge regarding the treatment of sál, it will be well to continue its cultivation on a small scale.

Blanks in the forest may, where the soil is rich and suitable, be utilized by cultivating túm; but, as a rule, I am disposed to advocate that all extensive blanks in this, as well as in the other forests of Kumaun and Garhwál, be utilized, either as grazing grounds, or by permitting cultivation on short leases. For this purpose it will be necessary to make very definite agreements with the cultivators regarding the pasture of cattle and the use of forest produce, so as to guard against injury to the adjoining forest and against encroachment. Eventually, I am of opinion that some of the forest land in West Kotah may, with great advantage, be let on long leases for the cultivation of tea. Tea plantations in the Darjeeling District, Bengal, are excellent customers to the forests, and consume large quantities of wood which would otherwise not readily find a market. These, however, are suggestions which cannot be taken up at the present time, but which will doubtless be acted upon at a future period.

Communications.

172. Besides the paths constructed along the fire-lines, there is an excellent system of cart-roads throughout these forests. Some of these roads are of a temporary nature, and have only been constructed to facilitate timber operations. Such is the system of cart-roads by which the Kotlia Forest has

* In Mowha-Ar and the adjoining flats a large number of mohwa (*Bassia latifolia*) trees have been cut, and it will probably be found that the wood of these trees will not decay for a long time to come.

been opened out, in which 300 trees were felled in 1880-81, most of which have been exported in the shape of logs. But the majority of the export roads are permanent, and, although they may not always be maintained in a condition fit for cart traffic, they can easily be converted into cart-roads when required, and they will always continue to be used for the export of scantling and wood of other kinds. The systematic arrangement of the cuttings here proposed will serve further to develop this system of export roads.

As an instructive instance of the system of export roads in these hill forests, I give below a brief account of the Kotlia Valley road and its feeders, built by Major Campbell, in 1879-80 and 1880-81, for the export of the timber cut in this forest.

The main road was 12 feet and the branch roads 10 feet wide, and the length and cost were as follows :—

	Rs.	A.	P.
Main Kotlia Sot road, length 4 miles 65 chains, breadth 12 feet, made in 1879-80	1,155	15	0
The six branch roads, aggregate length 1 mile 18 chains, breadth 10 feet, made in 1880-81	500	1	0
Total cost of construction ...	1,656	0	0
Cost of repair of the Kotlia Sot road in 1880-81 ...	165	10	0
GRAND TOTAL ...	1,821	10	0

315 trees were cut, yielding 13,600 cubic feet in the shape of logs. More trees will be cut and exported in the shape of scantling. The sketch-map appended illustrates the position of the work.

Rest-houses.

173. In the Kumaun Forests it is a matter of great importance to build a larger number of rest-houses, and the following is a list of the houses which, in accordance with the suggestions of Mr. Greig, the Conservator, I recommend should be built within the next ten years. It will be convenient to follow the plan adopted in Oudh, and to establish three classes of rest-houses :—

	Rs.
First class, two rooms in the upper story	3,500
Second class, one room in the upper story	2,600
Third class, ground floor only	550

Rest-houses proposed to be built in the Kumaun Division.

West Kumaun—

1 first class house at Rámnagar.
3 second class houses at Mohán, Leti, and Kalu Shahid.
10 third class houses at different places.

Abstract of cost.

	Rs.
1 first class house	3,500
3 second class houses, at Rs. 2,600 each	7,800
10 third class houses, at Rs. 550 each	5,500
Total ...	16,800

East Kumaun—

1 first class house at Chorgalia.
2 second class houses at Barmdeo and Dandaki Toti.
12 third class houses at different places.

Abstract of cost.

	Rs.
1 first class house	3,500
2 second class houses, at Rs. 2,600 each...	5,200
12 third class houses, at Rs. 550 each	6,600
Total ...	15,300

C. F. GUTHRIE, PHOTO.

Drawn in the Forest Survey Office by Munshi Tulsi Rám. July 1881.

C. G. OLLENBACH, ZINCO.

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún, August 1881.

The total cost of the rest-houses proposed for Eastern and Western Kumaun is thus estimated at Rs. 32,100, which, if spread over a period of ten years, will entail an annual outlay of Rs. 3,210.

Bamboos.

174. The export of bamboos from the forests of the Kumaun Division is as yet insignificant, as compared with the export of bamboos from the Garhwál Forests. Appended to this Report is a statement,* drawn up by the local officers, showing the bamboos exported from each revenue station between Láldhang and Barmdeo, and the following are the total exports, in scores, during ten successive years :—

1871-72	119,000
1872-73	205,000
1873-74	223,000
1874-75	131,000
1875-76	157,000
1876-77	174,500
1877-78	122,000
1878-79	116,000
1879-80	77,000
1880-81	122,000

These figures give no indication of any increased export, although during this period the extensive bamboo resources of the Nindhaur Forests have been opened out.

Produce removed by purchasers.

175. The following statement exhibits the revenue realized on produce removed by purchasers from the Kumaun Forests during the last four years. It will be noted that the export of khair has increased from Rs. 4,400 to Rs. 10,200, and that of sissoo from Rs. 444 to Rs. 2,083.

Revenue realized on produce removed by purchasers from the Kumaun Division from 1877-78 *to* 1880-81.

Produce.	1877-78.	1878-79.	1879-80.	1880-81.
	Rs. As. P.	Rs. As. P.	Rs. As. P.	Rs. As P.
a.—Timber—				
1. Sál, dry or fallen... ...	36,981 2 11	33,974 14 6	28,680 12 8	46,484 8 8
2. Khair	4,425 2 3	6,235 15 6	2,509 12 9	10,219 8 5
3. Sissoo	444 6 11	358 13 8	673 15 10	2,082 14 2
4. Other timber	8,193 8 2	7,800 8 0	5,087 15 8	6,205 4 5
b.—Firewood and charcoal	3,664 6 8	2,223 6 6	3,488 13 10	5,786 6 4
c.—Bamboos	12,047 8 11	10,473 2 7	6,390 14 10	11,290 8 10
d.—Grazing	8,392 2 10	9,220 14 9	9,875 9 2	10,266 6 0
e.—Other minor produce—				
1. Grass, including bhabar ...	2,184 9 6	2,555 14 9	2,375 9 2	3,241 6 0
2. Other items	9,263 4 11	14,537 7 0	12,837 1 11	13,391 0 1
Total ...	85,596 5 1	87,381 1 3	71,920 9 10	1,08,967 14 11

System of collecting revenue on forest produce exported.

176. The following is a brief account of the system, commonly known as the Kham Táhsil system, under which revenue on forest produce exported by purchasers is collected. This system was organised by Sir H. Ramsay when in charge of the forests as Commissioner of Kumaun.

* Appendix VI.

The usual practice is that certain tracts of the forests are, by a notification, declared open for the removal of certain classes of produce, such as firewood and charcoal, bamboos, grass, dry sál, &c. Any one who wishes to avail himself of this permission may enter the forests and extract these articles without a special license. But if any one wishes to export special articles, such as pieces of kúsam for sugar-mills, he applies for permission. Such permits are only granted by the Divisional Officer. It is considered to be an advantage, and to facilitate control, not to open the whole of the forest, but only certain tracts at a time. But, as a matter of fact, the whole forest area has always been open for the export of bamboos, grass (including bhabar), firewood, and most articles of minor forest produce.

Exporters are obliged to pay the dues for the produce and to take out a pass at the revenue station nearest the road by which they leave the forest. There are about twenty-two revenue stations in Kumaun, of which Rámnagar, Haldwáni, Chorgalia, and Barmdeo are the most important. The pass contains a full account of the produce paid for, and must be delivered up by the exporter at one of the check stations, most of which are on the lower road which runs near the boundary of the Tarái District. The original passes are all collected by the Foresters, who are in charge of the line of check chaukis, and who send the passes to the divisional office, where they are compared with the daily returns sent from the revenue stations.

At the head of the Kham Táhsil is a Forest Ranger, who is expected to travel continually along the line. A few of the revenue and check stations—such as Haldwáni, Káladhúngi, and Rámnagar—are kept open throughout the year, but the majority are generally closed from about the end of June to the beginning of November. During this period the Kham Táhsil establishments at the stations which are closed are on leave on half-pay or on smaller allowances.

Receipts and Charges. Local Staff.

177. The receipts and charges of the Kumaun Division during the last three years have been as follows:—

	1878-79.	1879-80.	1880-81.
	Rs.	Rs.	Rs.
Receipts	1,70,856	1,65,574	1,85,371
Charges	70,862	73,649	72,140

Mr. Greig, the Conservator, recommends the following staff of Rangers and Foresters for this division:—

Rangers.	Foresters.	Remarks.
1 on Rs. 150, Western Kumaun.	1 on Rs. 40 }	Rangers sanctioned—
1 „ 60, Eastern „	2 „ 30 }	1 permanent on Rs. 70.
„ 80, Superintendent, Kham Táhsil.	5 „ 20 } For charge of the 12 Ranges.	1 temporary on Rs. 120.
1 „ 50, for Roads.	4 „ 15 }	Foresters sanctioned—
	1 „ 30, Timber operations.	Permanent—1 on Rs. 40, 1 on Rs. 35, 1 on Rs. 30, 1 on Rs. 26, 3 on Rs. 25, 4 on Rs. 20, 3 on Rs. 15.
	1 „ 30, Depôt.	Temporary—1 on Rs. 20 for eight months and on Rs. 10 for four months, 7 on Rs. 15 for eight months and on Rs. 4 for four months, 3 on Rs. 15 for twelve months.
	2 „ 30, Deputy Superintendents, Kham Táhsil.	
	1 „ 15 { Writer with Superintendent, Kham Táhsil.	

CHAPTER VII.

SUBMONTANE FORESTS IN GARHWÁL.

Ganges Division separated from Garhwal Division.

178. The forests which occupy the outer hills of the Himalaya, between the open country at the foot of the hills and the open country on the higher hills in the Garhwál District, and which is bounded by the Phika River on the east and the Ganges on the west, supply Western Rohilkhand and a large portion of the Doáb with timber, firewood, and bamboos. A belt, varying in width on the northern edge, has been set apart to provide for the residents of the adjoining villages in the hills ; and on the lower edge also a considerable area has been excluded from forest limits, to suit the convenience of the villages at the foot of the hills in the Garhwál and Bijnor Districts.

The area of these forests, arranged according to civil districts and to forest divisions, is as follows :—

Forest Divisions.	In Bijnor District.	In Garhwál District.	Total area of Forest Divisions.
	Acres.	Acres.	Acres.
Garhwál	15,719*	268,320	284,039
Ganges	20,882	90,560	111,442
Total ...	36,601	358,880	395,481

The boundary between the Garhwál and Ganges Divisions is the valley of the Koh River, near Kotdwára.

Garhwal Division. Rehar Forest.

179. The Garhwál Forest Division, as at present constituted, comprises 268,320 acres in the Garhwál District, and the Rehar Forest, measuring 15,719 acres, in the Bijnor District. The Rehar Forest is a stretch of high ground, about nine miles long and on an average three miles wide. The upper portion of this forest is reported to be stocked with sál poles of smaller dimensions and less densely grown than those in the adjoining forest of Garhi Bulchand in Kumaun; while the lower portion consists of broken ground stocked with katbhiláwa *(Buchanania latifolia)*, thorns, and grass. This forest furnishes, for export, timber, firewood, grass, and other minor produce. It was formerly under the Collector of Bijnor, and was transferred to the Forest Department in November 1879. It has been worked under the Kham Táhsil system since the autumn of 1880. There are no grazing rights in the forest, but the north-eastern corner has been left open for the pasture of cattle belonging to three villages on the submontane road, and the low-lying land (khádar), which is flooded every year by the Phika Nadi, is annually let out for grazing. With these two exceptions, the whole area is under protection against fire, the arrangements for which were commenced in the autumn of 1880.

Forests in the hills of the Garhwal District.

180. The large area of forest in the outer hills of the Garhwál District is drained by the Kohtri River, a tributary of the Koh, and by the Rámganga and

* Besides this area, there is the southern part of the Chándi Forest, under the Collector of Bijnor, measuring 18,497 acres; hence the figures entered in the Report for 1880-81 are :—Bijnor District 34,216 acres, Garhwál District 268,320 acres; total 302,536 acres.

its feeders, the chief of which are the Sona Nadi and the Palain* and Mundál Rivers. The Mundál River forms the northern boundary of the forest, if two blocks be excepted, the one called Gui, opposite to Banjadeh, the other Kalakhan, near the junction of the Mundál and Rámganga Rivers.

For administrative purposes and for working, the hill forests of the Garhwál Division may most conveniently be divided into the following six ranges:—Dháron, Sona Nadi, South Pátli Dún, North Pátli Dún, Palain, and Kohtri Dún.†

Dharon and Sona Nadi Ranges.

181. Two of these ranges are situated in the outer Siwálik portion of the hills, *viz.*, the Dháron and the Sona Nadi Ranges, and they are separated by the Rámganga River. The northern boundary of the Dháron Range is formed by a fire-line, which runs from Boksár to Jamnágár on the Kothiráo, near the Kumaun boundary. The northern boundary of the Sona Nadi Range is the crest of the high ridge which separates that valley from the valley of the Mandálti River.

The land included in these two ranges consists chiefly of irregularly broken ground, alternating with a considerable extent of flats in the principal valleys.

The forest is irregularly and very imperfectly stocked, mostly poor and open, the most valuable trees being bamboo and scattered patches of sál, nowhere of considerable extent, in the valleys and on the flats. Sissoo and khair of small dimensions are found along the beds of rivers.

Shishamkhata Forest.

182. The only portion of these outer Siwálik ranges that is protected against fire is the sál forest of Shishamkháta, below the hills west of the Rámganga River. The most valuable portion of this forest consists of about 2,000 acres of nearly level ground, forming two distinct terraces. The whole area must at one time have been one of the finest pure sál forests in these hills. The soil is a deep loam, and very well suited to the growth of sál. But this forest, being easily accessible, was cleared of all marketable timber probably before 1858. The tops and branches, and in many cases entire trees which were cut, but not removed, remained on the ground and increased the violence of the annual fires, thus preventing most effectually the growth of young sál.

At present the ground is stocked with scattered, large, hollow trees, and with groups and patches of tall and vigorous poles. Save along the ravines, there is hardly any kind of tree besides sál. Between the trees the ground is covered with grass, which is more than 6 feet high on the lower terrace and about 3 feet high on the upper. Above the upper terrace the sál forest extends for a considerable distance up the slope of the hills.

Successful fire-protection commenced in 1878, and the upper portion has been saved during the three successive hot seasons of 1878, 1879, and 1880. During 1880 the whole of the forest was protected. The result of this protection is seen in a large number of seedlings and coppice-shoots among the grass, which, if protection is successfully continued for a few years longer, will develop and kill out the grass. Thenceforward fire-protection will be easy, and the satisfactory progress of the forest will be secured.

* Called Pelání on the accompanying Map.

† The following is the estimated total area and the area of sál forest, in acres :—

Ranges.	Total area.	Area of sál forest.
Rehar	22,000	20,000
Dháron	37,120	10,000
Sona Nadi	58,240	20,000
South Pátli Dún	30,080	15,000
North Pátli Dún	58,240	50,000
Palain	40,960	30,000
Kohtri Dún	42,880	30,000
Total ...	289,520	175,000

Regarding the future treatment of this extremely valuable forest, it will suffice to say that no effort must be spared to ensure continued protection from fire, and that after the ground has become completely stocked with young growth, and after that young growth has sufficiently advanced to be safe from frost—which is unusually severe, particularly in the lower portion —large quantities of marketable timber may be cut. In selecting the trees to be felled, due regard should be paid to the circumstance that in this rich soil young scattered trees will rapidly increase in size and value, and that therefore it may in some cases be profitable to leave groups of vigorous young trees standing.

Sal in the rest of the Dharon and Sona Nadi Ranges.

183. In the rest of these two outer Siwálik ranges, there is nowhere any sál forest to be compared to that of Shishamkháta. Groups and patches of poles and old trees, as already stated, are found here and there, but there are no forests which, for the sake of the sál, seem at present to require special protection.

As regards the extraction of bamboo and khair from these outer hills, existing arrangements must continue for the present. The forests in the inner ranges require special protection more urgently, and hence I do not at present advocate any change in the management of the Dháron and Sona Nadi Ranges.

South Patli Dun Range.

184. The hills to the north of these two outer ranges may most conveniently be divided into three ranges, the South Pátli Dún, the North Pátli Dún, and the Palain Ranges.

The South Pátli Dún Range comprises the hills south and east of the Rámganga River and the level ground on the left bank of that stream. It is traversed by two roads leading from Dháron, at the foot of the hills, to the country north of the Mundál River. The western road is called the Sirakiráo road, and the eastern the Taulia road. It is also traversed from west to east by the forest road from Boksár to Barsoti. Partly through the southern part of the range runs the road from Boksár to Rámnagar.

Fire-protection.

185. Along the crest of the ridge which bounds the Rámganga Valley on the south, and which it will be convenient to call the Dánapáni ridge, a fire-line has been cleared and a bridle-path made. An intermediate fire-line has been cleared between the crest and the Boksár-Barsoti road. There are also a number of intermediate fire-lines from the northern edge of the forest to the crest, and some from the crest to the outer fire-line.

Between the lower edge of the forest and the Rámganga River intervenes, from Boksár to Sarapduli, a continuous stretch of grass land about ten miles long and on an average one mile wide. A great portion of this land was formerly cultivated, and near Dhikani there are the remains of old temples, with carvings, and of an old fort. The present practice is to burn these grass lands early in the season, and the whole of the forest above them is protected against fire.

The first attempt to protect this portion of the forest was made in 1864 by Mr. R. Thompson, then Assistant Conservator under the Commissioner, but it failed, because the fire-lines made by him were too narrow. Fresh attempts

were made in 1873, and in 1874 six square miles between the ridge and the Rámganga River were saved. The protection of that portion was attempted annually, but not with uniform success.

South of the range protection was commenced in 1877, but here also success was only partial. The first time when the whole forest escaped from fire was the hot season of 1880.

Character of forest.

186. Regarding the general character of the forest in this range, it will suffice to say that the slopes south of the ridge are similar in character to the Dháron Range, with a large amount of chír; but in the lower part there is a considerable area under sál similar to, but not so extensive as, the sál forests in the lower Ratapani tract in the Meláni block of Western Kumaun. Cuttings were made near the Gaujpani in 1880, yielding 70,000 cubic feet of timber. There are other tracts south of Dánápani which will yield mature timber after fire-protection has made some progress; but no operations are recommended at present in this part of the range.

North of the Dánápani ridge the character of the forest differs widely, according to the nature of the ground. On broken ground and near the crest of the ridge the forest is more mixed and open, and creepers are exceedingly numerous. On gentle slopes and on level ground near the northern end of the forest, the growing stock consists chiefly of large hollow or irregularly shaped trees, the ground being covered with grass or with irregular young growth, in which in many places dhaura (*Lagerstrœmia parviflora*) preponderates. Here, as elsewhere, it is evident that in good deep soil this species thrives in spite of the fires, just as on hilly ground katbhiláwa (*Buchanania latifolia*) seems to resist the fires, and is here, as elsewhere, often seen covering considerable tracts on the slopes.

Protection from fire will doubtless have the effect of stocking the ground with a satisfactory young growth of sál; but the young forest which will grow up in the South Pátli Dún Range will, in most cases, be of a very mixed character.

An exception must, however, be made in regard to that part of the South Pátli Dún Forest which is on level ground near the river. This is in every respect similar to Shishamkháta, and will, if protected from fire, probably grow up into a nearly pure sál forest.

In the western part of the South Pátli Dún Range, north of the Dánápani ridge, are considerable areas of forest of sál poles, which would seem to indicate that the forest in these places was cut, possibly for the sake of cultivation, at a period previous to the time when the Pátli Dún Forest was worked by Captain Read.

Young growth on abandoned fire-lines.

187. A few points of special interest should here be mentioned. In 1873 and 1874 a large number of transverse fire-lines, 60 feet wide, were cut running from the crest of the hills to the Boksár-Barsoti road, some of which have not been maintained and have not been cleared since they were cut. Here and there, but only on very favourable soil, have these lines become stocked with young growth of sál. In most cases they are imperfectly stocked with young growth of other trees, among which *Lagerstrœmia* is prominent, although the number of seed-bearing sál trees in the vicinity of these lines is generally considerable.

Young growth of Singrau.

188. The second point is the large quantity of young growth of singrau (*Tetranthera monopetala*), both on the lines and in the forest. This species, as is well known, does not, save in exceptionally rich soil (as at Ruhni), attain any large size. It is a soft wood, which bears seed while a shrub, and it will probably not in any way injuriously affect the growth of sál in this forest.

Cutting of Sandan and Sal.

189. In this range the large quantity of sándan is remarkable. I understand that there is a considerable demand for this wood. At present only dry sándan is allowed to be cut. As a rule, it will at present be more convenient to cut sándan in the North Pátli Dún Range, where, as will be explained further on, regular cuttings of sál are recommended. However, I see no objection to the occasional cutting of a small number of mature sándan trees in the South Pátli Dún Forests.

As regards sál, all that I can say at present is that the effect of continued fire-protection must be watched. After the young growth has progressed sufficiently, a certain (though not a very large) quantity of marketable timber will be available in this range. But in the greater part of it, it will be necessary to cut, simultaneously with sál, trees of other kinds.

Roads: cutting of creepers.

190. With the exception of the two roads previously mentioned, and of the Boksár-Barsoti and Boksár-Rámnagar roads, which are both used for traffic, very few of the fire-lines have as yet been used for the export of dry wood from the forests. I am disposed to advocate that some of the transverse lines be made fit for cart traffic, and it should be noted whether the effect of the measure will be to increase the export of dry wood.

A measure of a different kind, which is urgently required for the improvement of this forest, is the cutting of creepers, which are very common and very destructive.

North Patli Dun Range.

191. The North Pátli Dún Forest is bounded by the Rámganga River on the east and south, by the Palain on the west, and by the northern boundary of the forest and the road from Palain to Jharrat on the north.

The Taria ridge, which forms the line of water-shed between the Mundál and the Haldgadi Rivers on the north and the Rámganga on the south, runs within a distance of less than one mile from the valleys of the Mundál and the Haldgadi, while its distance from the Rámganga averages four miles. The average elevation of the Mundál Valley is 2,000 feet, while the Rámganga Valley at Taulia is only 1,200 feet high, the highest point of the ridge which divides the waters of these two streams being 3,850 feet.

With the exception of one-and-a-half miles from the mouth and half-a-mile at the west end, the northern slope of the hills towards the Mundál is open to the exercise of recorded rights, the chief of which are pasture of cattle and the cutting of timber, including sál, for their own requirements, on free permits granted by the Divisional Officer.

Protection from fire has not yet been attempted in a regular manner in this portion of the range, but it should be mentioned that the villagers

themselves have protected the forest during the hot season of 1880, and it is intended, with their assistance, to make an attempt to protect this portion also permanently.

The hills which compose the North Pátli Dún block are drained by numerous feeders of the Rámganga and Palain Rivers, of which the following are the most important:—

(1) The Adnála: the forests in the basin of this stream have, with few exceptions, never been worked. (2) The Baila Nala, which drains a large area of undulating ground that has been most heavily worked. These two streams are feeders of the Palain River, and the following join the Rámganga direct:—(3) the Gaujera, (4) the Phulai, (5) the Keláni, which joins the Rámganga at Taulia, (6) the Boksagadi, (7) the Bilot, (8) the Maulia, (9) the Khakasgadi.

Valuation survey why made.

192. Owing to the difficulty of carriage, the forest near the head-waters of these streams, and the whole forest drained by the Adnála, the Khakasgadi, and the Maulia Rivers, have been worked either not at all or only to a small extent; and it was therefore decided in 1877 to make a regular valuation of the forests which have now been included in this block, with the view of basing thereon a regular plan of working. As a matter of fact, these forests are, with few exceptions, the only ones in Garhwál where any large quantities of mature sál timber remain, and where consequently cuttings on a large scale can now be made.

Mr. Dansey was employed during the open seasons of 1877-78, 1878-79, and part of 1879-80 in making the valuation survey of this forest, in dividing it into compartments, and in drawing up the outlines of a working-plan. It will suffice in the present pages to refer to Mr. Dansey's Report, and briefly to state the conclusions which, after examining a portion of the ground, I have formed with regard to the future treatment of this area.

Slope towards the Mundal excluded.

193. That portion of the northern slope towards the Mundál River which is open to village rights has been excluded from the Report, but a separate valuation survey of it has been made.

As might be expected, this slope, which has hitherto been subject not only to the annual fires, but also to constant grazing of cattle, shows very poor reproduction; and, although there is a large quantity of mature timber on the ground, cuttings cannot be contemplated until protection from fire has been established and has been continued for a considerable period.

Three large blocks.

194. The area to which Mr. Dansey's proposals relate comprises 50,781 acres. It has very properly been divided by him into three great divisions or groups of compartments, which differ in the character of the forest and in the degree to which the forest has been worked. The term "division" in this case is likely to cause confusion, and I prefer to regard these groups of compartments as blocks for the present, and to designate them as the Rámganga, Taria, and Adnála blocks. The whole of these three blocks, excepting the south-western portion, has been divided into compartments, and the trees of the

different classes have been counted. The following is an abstract of the area of these three blocks :—

Blocks	Area.	Number of compartments.	Average area of compartments.
	Acres.		Acres.
I.—Rámganga	27,551	51*	347
II.—Taria	14,336	44	326
III.—Adnála	8,894	19	468
Total ...	50,781	114	...

* These 51 compartments only comprise an area of 17,687 acres, the rest not having been divided into compartments or surveyed.

Ramganga block.

195. The Rámganga block (Mr. Dansey's first division) comprises the entire basin of the Baila Nala and of several other streams in its vicinity which fall into the Rámganga, as well as the lower course of the Gaujera basin, nearly the whole basin of the Phulai, and the lower two-thirds of the Kelani and Boksagadi Valleys. This block, as pointed out in the Report, is very accessible, and has therefore been worked to such an extent that it contains little beyond isolated and mostly unsound old sál trees, with small poles and groups of saplings.

Mr. Dansey correctly recommends that this block must be left undisturbed and carefully protected from fire for a period of eight or ten years, when it may be expected that a uniform young forest of sál will occupy most of the ground, and will permit the removal of the remaining old trees as far as they are marketable.

In this block the soil is generally deep, and the conditions for reproduction are exceedingly favourable. It has another advantage, that its elevation is less than that of the other blocks. The elevation is estimated by Mr. Dansey at 1,800 feet on an average.

Taria block.

196. Taria block (Mr. Dansey's second division) comprises the hills drained by the Khakasgadi and Maulia streams, and the upper portions of the Gaujera, Keláni, and Boksagadi basins. It also comprises the upper part of the hills and that portion which faces the Rámganga, where this river forms the boundary between Kumaun and Garhwál. Regarding this block I cannot do better than give the following extract from Mr. Dansey's Report :—

"*Constitution.*—This division comprises 44 compartments, the average area of each of which is 326 acres. If we except a very slight and partial working of compartments 1, 2, 3, 4, 12, 13, 14, 17, 19, 27, 28, 29, 38, this portion of the working circle has never been felled over for timber purposes. The reason of this lies apparently in the distance of the region, the greater difficulties of transport, and the steeper and more rugged nature of the ground. As a general rule, the compartments are here separated by very distinct natural features, and present within themselves a condition of vegetation that is apparently different in the case of every compartment.

"*Configuration of the ground.*—About two-thirds of the area of this division are included in the upper extremities of the basins which go in great part to form division I. The water-shed of the Rámganga and Mundál forms the highest point of this region. As might be expected, the several large streams already known to the reader have greatly narrowed themselves here, while the ground has become decidedly hilly, steep, and difficult when compared with that of division I. With few exceptions, an alternation of steep, stony slopes and narrow, deep gorges distinguishes all this region. Again, the ground is always prominently exposed at some aspect or another. The low, undulating, ill-defined features

which so largely characterise division I have here quite disappeared. The remaining third or more of this division, comprising all the easterly extremity of the working circle, has, in every respect, the same general features as the above. Although here, as elsewhere, cold and warm expositions alternate with one another, even in the case of the same compartment, the proportion of ground with aspects favourable to good sál vegetation is considerable. The average altitude of all this tract can be put down at 2,000 feet above the sea and 800 feet above the river. The average angle of slope can be roughly estimated at 25 degrees.

"*The soil and underlying rock.*—In this division, extreme qualities as regards the soil recur at very short intervals in the case of every compartment. The general steepness of the ground and its indefinite division by ravines, running in a great variety of directions, are the corresponding causes of great changes over small areas in the aspect, and hence in the soil itself. There are but few compartments in this division which cannot be said to include both extremely good soil and extremely bad soil, and the proportion of the one to the other varies according to the situation of each compartment. The soil at warm aspects is, outside the ravines, hollows, or depressions (situations not only protected, but in which the soil has accumulated from the higher regions), extremely stony, dry, thin, and barren. It is here mainly gravel with larger stones intermixed, both produced by the disintegration of the underlying shales and sandstones, the more clayey or sandy particles of which have been washed down to lower levels. At cold aspects, and in enclosed localities, the soil is deep, fresh, and rich in mould, or thin and stony (or even rocky), according as the ground is very steep or the reverse. The elements in the soil are much the same here as at other aspects, sandy or clayey loam being prevalent in bottoms and gravel or a gravelly loam on the slopes.

"*Condition of the forest.*—As we might expect from what has already been said touching the sudden and constantly recurring changes in the aspect of the steep slopes characterising this division, there are great corresponding differences in the vegetation. Pure forest of sál on one side of a ravine is opposed to very mixed forest on the other. In the former we often see superb trees, in the latter almost always miserable specimens of all species. In this division the ground is generally well covered, in which it differs from division I, which has been, as I have already said, worked over at repeated intervals. In consequence, trees of all ages, and sound and unsound trees, recur here in more just proportion, or, at any rate, the relation in which they are found is more natural than in the case of division I. But even here the proportion of old trees is disproportionate in the majority of the compartments. * * * Fires have hitherto been an annual occurrence in this as in the other divisions, and the success of the young seedling is only ensured after a long course of years, during which it can be said to have lived in a continuous fashion underground only, the shoots sent forth by the root each year having been subject to annual destruction by fires. To this fact may be partly due the present scarcity of young trees. To it is certainly due the gnarled and sickly appearances of so many of them. Although, from the absence of young growth, the old trees are often more apart on the ground than they should be, there is apparently a rich supply of sál timber immediately available in this division, as also of sain. Bamboos are particularly abundant and fine throughout the division."

Adnala block.

197. The Adnála block (Mr. Dansey's third division) comprises the basin of the Adnála, which, as already stated, has never been worked, and which, as Mr. Dansey correctly observes, presents certain marked differences, in the vegetation, the ground, and other important particulars, from the second block. This block consists of two unequal portions, which are separated by the high ridge of water-shed between the Haldgadi and Adnála streams, which is a continuation of the Taria range of hills. This narrow steep slope, which faces the Haldgadi and its feeder the Shivália, west of the Haldgadi Pass, as well as the Nauni Nala, a feeder of the Mundál, east of the pass, is stocked with one of the finest sál forests in Garhwál, consisting of trees and poles of all ages, with a considerable quantity of well grown mature timber. The cover in many parts is so dense that it has protected itself against fire, and the ground is covered with the dry leaves of several seasons. The rest of the block comprising the Adnála Valley may most conveniently be divided into three portions—the right bank, the greater part of which faces south ; the head of the valley ; and the left bank, consisting mostly of northerly slopes, many of which are as well stocked and as valuable as the slopes facing the Haldgadi Valley.

One characteristic feature of this block is the scarcity of bamboos, and another is the large extent of poor clayey soil, stocked at present with forest more or less open and stunted, in which the trees do not grow to any large size, and attain maturity with a girth of 4 or 5 feet. This portion of the forest resembles many tracts of eng forest (*Dipterocarpus*) on poor soil and broken ground in Burma. But even this part of the block, which is the least promising, will certainly improve if continuously protected against fire. Upon the whole, the Adnála block is an exceedingly valuable portion of the Garhwál Forests.

Annual maximum yield as regards Sa

198. As regards working, Mr. Dansey correctly advocates that cuttings during the next period should be limited entirely to the Taria and Adnála blocks (Mr. Dansey's 2nd and 3rd divisions). Although we have a complete knowledge of the growing stock of different sizes in this working circle, we are here, as in the Nindhaur Forests, under the great disadvantage that we know very little regarding the rate of growth of sál. Based on the data which are at present available, Mr. Dansey has estimated the annual yield of the forest, if worked according to strict conservancy principles, at 3,626 trees above 4 feet 6 inches in girth, of which he expects that 2,568 trees will be sound.

I have no reason to doubt the correctness of his conclusions, but it seems to me prudent in this case, as in that of the Nindhaur Forests, to limit the cuttings during the next few years to a figure considerably below the possible annual yield of the forest. When we are as yet in uncertainty regarding one of the two great factors upon which the provisions of the working-plan must depend, this is undoubtedly the proper course to follow. Assuming that the average yield of the trees which will be felled in these forests will be 30 cubic feet each, an annual outturn of 50,000 cubic feet may be obtained by the felling of 1,667 trees. And I am of opinion that for the present we ought to be satisfied with an annual outturn of 50,000 cubic feet.

Two classes of cuttings (of Sal) proposed.

199. Considering the general character of the forest, it is evident that two classes of cuttings may be made—*first*, in those portions where it is necessary to cut out the larger trees, in order to give sufficient light to enable the young growth of sál to spring up and to develop vigorously; *second*, the cutting out of the marketable timber on ground which is already stocked with young growth. Before, however, discussing the principles which should guide these cuttings, it will be necessary to consider the present condition of these forests in regard to fire-protection.

Fire-protection in this block was commenced in 1877, but without success; and it did not succeed until 1880, when the whole area east of the Keláni Valley was protected. Steps have been taken this season to extend protection to the Gaujera Nadi, and it is most desirable that, as soon as possible, the whole of the forest included in this area should be protected. As regards the Adnála basin, there ought to be no difficulty, as it is at present quite inaccessible and not visited by anybody. The greatest difficulty will probably be experienced in the south-west corner, comprising the Baila Nala and adjoining basins, but no efforts should be spared to overcome this difficulty.

Cuttings (of Sal) at present only admissible in forests hitherto untouched.

200. From these remarks it will be understood that no part of the forest is sufficiently advanced to justify cuttings of the second class as defined above.

It must be remembered that matters here are in a position quite different from what they are in West Kumaun, where fire-protection has been continuously successful for the last five years, and where over large areas the young growth is sufficiently advanced to enable us to cut out the old timber standing over a well-stocked forest of saplings and young poles. Hence the only cuttings which are admissible, and will be admissible for a long time to come, are those in forests not yet touched, where it is necessary to remove a portion of the larger trees in order to give light for the young growth to come up.

Sketch of arrangements proposed.

201. The following is a sketch of the arrangements under which I suggest that the annual cuttings during the next twelve years at least, but probably during a longer period, should be made.

In framing any arrangement of cuttings in these forests, the main point to be kept in view is that, in a forest in which fire-protection has only just been commenced, cuttings must be made with the greatest caution. It has already been explained that in this respect the conditions are widely different from what they are in the West Kumaun Forests, which have been successfully protected from fire during the last five years, and where in consequence the young growth has made considerable progress. Until this point has been attained, cuttings are admissible only in selected localities, where the cover overhead is so dense that unless light is given the young growth cannot come up.

Limitation of cuttings (Sal).

202. Mr. Dansey's proposals, which have been carefully considered, amount to this, that during the next ten years 3,626 mature sál trees, down to 18 inches in diameter, may be cut annually, the cuttings being confined to the Taria and Adnála blocks (divisions II and III). As already explained, I am of opinion that, considering the backward state of protection of this area, the annual cuttings during the next period must be confined to a much smaller quantity, and that these cuttings should only be made in selected localities, where the forest consists mainly of mature timber.

Order of cuttings.

203. As regards the order in which these cuttings should be made, two points must chiefly be taken into consideration—the condition of the forest, and the convenience of working.

Cuttings have been commenced this year (1880-81) in compartment No. 15, Rámganga block (division I), on the left side of the Gaujera Valley, where 237 trees, in girth above 4 feet 6 inches, were marked in 1880, most of which have been cut and exported in the shape of scantling. Operations having thus already been commenced in this basin, which is readily accessible and which does not require much immediate outlay for roads, &c., it will, in the opinion of the local officers, be convenient to continue them here; and although there are other portions of the range which are further advanced as regards fire-protection, and where the condition of the forest is otherwise more ready for immediate cuttings, there is no objection to the continuance of cuttings in this basin at present.

The following statement shows the compartments in which cuttings are proposed to be made, and the order in which they are proposed to be taken up, with the area of each compartment, and the number of trees, in diameter above 18 inches, counted in them by Mr. Dansey:—

Abstract of compartments in the North Pátli Dún Range in which fellings are proposed to be made during the twelve years from 1881-82 *to* 1892-93.

Year of fellings.	Locality of fellings.		Area, in acres.	Number of Sal trees counted.			Remarks.
	Name of basin.	Number of block and compartments.		First class, above 2 feet in diameter.	Second class, from 18 inches to 2 feet in diameter.	Above 18 inches in diameter, per acre.	
1881-82	Gaujera.	I 15	624	1,601	2,245	6·16	Left bank of Gaujera.
		„ 17	450	1,634	1,797	7·68	
		II 12	378	908	1,431	6·19	
		„ 13	289	568	1,037	5·55	
		„ 14	340	532	1,311	5·42	
			2,081	5,243	7,821	6·28	
1882-83		II 3	420	786	1,586	5·64	Right bank of Gaujera (lower portion).
		„ 4	252	416	913	5·27	
		„ 5	479	1,239	2,478	7·74	
		„ 10	332	664	1,559	6·69	
		„ 11	387	829	1,671	6·45	
			1,870	3,934	8,202	6·49	
1883-84		II 1	204	349	582	4·56	Right bank of Gaujera (upper portion).
		„ 2	479	896	2,054	6·16	
		„ 6	436	1,548	2,782	9·93	
		„ 7	347	654	1,773	7·00	
		„ 8	440	534	1,814	5·33	
		„ 9	274	341	1,320	6·05	
			2,180	4,322	10,325	6·72	
1884-85	Khaksagadi.	II 38	648	2,591	3,519	9·42	Left bank of Mundál.
		„ 39	233	896	1,345	9·63	
		„ 40	342	524	1,498	5·91	
		„ 41	267	608	1,162	6·62	
		„ 42	223	363	606	4·33	
		„ 43	163	169	616	4·81	
		„ 44	385	870	3,017	10·10	
			2,261	6,021	11,762	7·87	
1885-86	Haldgadi.	III 1	942	2,202	6,962	9·72	Left bank of Haldgadi, Shivalia, and Naun streams.
		„ 2	169	152	533	4·04	
		„ 3	96	76	342	4·35	
		„ 4	184	178	704	4·79	
		„ 5	406	1,009	2,183	7·86	
			1,797	3,617	10,724	7·98	
1886-87	Adnála.	III 15	456	1,888	3,091	10·91	Left bank of Adnála (lower end).
		„ 16	252	1,137	1,899	12·03	
		„ 17	122	314	884	9·79	
		„ 18	130	249	820	8·22	
		„ 19	265	325	1,261	5·98	
			1,225	3,913	7,955	9·68	
1887-88		III 12	209	712	1,557	10·86	Left bank of Adnála (middle portion).
		„ 13	310	882	1,996	9·24	
		„ 14	739	2,943	4,880	10·59	
			1,258	4,537	8,423	10·30	
1888-89		III 9	824	1,435	4,022	6·62	Sources of Adnála.
		„ 10	413	881	1,943	6·84	
		„ 11	478	1,904	3,498	11·30	
			1,715	4,220	9,468	7·98	
1889-90		III 6	531	1,530	3,565	9·59	Right bank of Adnála.
		„ 7	762	1,323	3,977	6·95	
		„ 8	1,603	3,111	7,880	6·85	
			2,896	5,964	15,422	7·38	
1890-91	Kelani-Boksagadi.	I 29	438	998	1,730	6·23	Head of the Kelani and Boksagadi streams.
		II 17	241	347	755	4·57	
		18	410	648	1,857	6·11	
		„ 19	471	852	1,694	5·40	
		„ 20	261	213	662	3·36	
		„ 21	347	208	942	3·32	
		„ 22	337	557	1,464	6·00	
		„ 23	345	358	1,048	4·08	
			2,850	4,181	10,152	5·03	
1891-92	Bilot.	II 24	343	491	1,175	4·35	Head of the Bilot Valley.
		„ 25	317	393	913	4·12	
		„ 26	197	347	1,161	7·66	
		„ 27	369	791	1,282	5·62	
		„ 28	428	810	1,487	5·36	
		„ 29	155	803	607	9·09	
			1,809	3,635	6,625	5·67	
1892-93	Maulia.	II 30	456	1,448	2,441	8·52	Right bank of the Rámganga, near the mouth of the Mundál.
		„ 31	415	616	1,415	4·89	
		„ 32	275	180	582	2·76	
		„ 33	150	420	665	7·21	
		„ 34	387	507	1,035	3·99	
		„ 35	90	103	310	4·57	
		„ 36	251	429	951	5·49	
		„ 37	186	333	945	6·87	
			2,210	4,036	8,344	5·60	
	Grand Total ...		24,152	53,623	115,223	6·99	

Gaujera basin.

204. It will be noticed that that portion of the Gaujera basin in which cuttings are proposed to be made comprises 16 compartments, two of which (15 and 17) belong to the Rámganga block (division I), while the remainder are in the Taria block (division II). All these compartments contain patches of well-stocked forest, in which the removal of a proportion of the larger trees is necessary, in order to promote the reproduction of sál.

To 1881-82 I would assign the remaining compartments on the left side of this valley, two of which, though situated in the Rámganga block (division I), may be included, as they contain a sufficient area of well-stocked forest. From the figures of this statement it will be noticed that the total area assigned to this year is 2,081 acres, on which 5,243 trees of 2 feet diameter and upwards, and 7,821 trees between 18 inches and 2 feet in diameter, have been counted.

The existing practice in timber operations in Garhwál is to measure the girth and not the diameter, and there is no reason why, for the present purpose, we ought to insist on a change of this practice. As a rule, I think it will be well to lay down that no trees under 6 feet in girth should be cut, but that exceptions be made in localities where, owing to poor soil or other circumstances, trees attain maturity at a smaller size, and where they are not likely to increase considerably in girth. If this is agreed to, then, besides the trees 6 feet in girth and upwards, a certain proportion of smaller trees will be cut. On the assumption made in a previous paragraph, that the trees cut will, on an average, yield 30 cubic feet each, the annual outturn of 50,000 cubic feet which it is proposed at present to fix as the limit will require the felling of only 1,667 trees. It is therefore evident that the compartments assigned to the first year will be ample, even under the most rigid system of selecting the trees to be cut, to furnish this timber. Indeed, it is most probable that, as the cuttings progress, it will be found that a small portion of the area assigned to each year will, as a rule, furnish the necessary quantity.

In that case, what I recommend is that cuttings on the system prescribed be continued, in the area assigned to the first year, during the second and, if necessary, also during the third year. In this manner the arrangement will be elastic, and will readily adapt itself to the practical requirements of these operations.

From the statement recorded in paragraph 203, it will be seen that two years have been assigned to the cuttings in the compartments on the right bank of the Gaujera, which are all situated in the Taria block (division II), and that, according to this assignment, the cuttings at present contemplated in the Gaujera basin will be completed within a period of three years. It will, however, also be understood from the preceding remarks that this basin will most probably furnish material for successive cuttings during a much longer period than three years.

Khakasgadi basin.

205. After the completion of the work in the Gaujera basin, I recommend that the forest near the mouth of the Mundál River and in the Khakasgadi Valley be taken in hand. From the statement it will be seen that the compartments assigned to that year contain a large number of trees of the first and second classes. In fact, they are regarded by Mr. Dansey as the best stocked forests of the whole range. This area, which has been designated as the Khakasgadi basin, will doubtless furnish material for the operations of more than one year.

Gaujera why placed before the Khakasgadi basin.

206. Up to this point the whole area assigned is included within the forest either already protected from fire, or the protection of which is about to be undertaken. At present the western limit of fire-protection is the road

which follows the Gaujera Valley, and it should be distinctly understood that the cuttings must not extend to the right bank of that stream until the protection of that part of the forest against fire is assured.

In some respects it would have been preferable to commence operations in the Khakasgadi basin, and this was the plan recommended in Mr. Dansey's Report. The chief reason for taking the Gaujera basin first was that the arrangements for the export of timber from the Gaujera basin are in a sufficiently advanced state to justify the continuance there of timber operations, whereas it will require some time to open up the forests near the mouth of the Mundál and in the Khakasgadi basin. I may mention that the timber from the last named forests will be exported not *viâ* Kálágarh, but *viâ* Rámnagar. In this case, therefore, the convenience of working has been allowed to prevail over other considerations.

Haldgadi basin.

207. After operations in the Khakasgadi basin have been completed, I am of opinion that the northern face of the range which divides the Haldgadi from the Adnála should be taken in hand. A large portion of this area is comparatively young forest, well stocked with poles and with a proportion of mature trees. It is an extremely valuable part of the forest, in places almost pure sál, and the selection of the mature trees to be cut here will require special care. I do not propose at present to enter into the question how the first cutting should be made in a forest like this, which is nearly complete in many parts, except where the slopes are precipitous and the soil poor. It is possible that in these compartments it may be found desirable to adopt a regular succession of cuttings—the *first* to give light for the seed to germinate, the *second* to enable the seedlings to grow up into thickets of saplings, and the *third* for the gradual removal of the old trees. This, however, will be a matter for special consideration when the time arrives for commencing cuttings in this part of the forest. By that time more experience than we possess at present will have been gained regarding the effect of fire-protection upon forests of this description.

The present condition of this forest is similar to what a great part of the Durgadeh Forest was in 1863, and it is to be hoped that, as regards the regeneration of the forest, its treatment will be more successful than that of the Durgadeh Forest has been hitherto. It must of course be understood that, long before operations are commenced in the Haldgadi basin, fire-protection must have been firmly established over the whole of the North Pátli Dún Range, as far as it is included in the present proposals.

Forest on the right bank of the Haldgadi.

208. I may here mention that the forest on the right bank of the Haldgadi is exceedingly valuable. East of the Haldgadi Pass the forest is open to the exercise of rights, but west of it there is at the entire disposal of Government a large area of well-stocked forest, chiefly mixed sál and sain in the upper part, and principally sál in the lower. This forest may, as far as the extraction of timber is concerned, be regarded as part of the Haldgadi basin. I am strongly of opinion that it should be included in the fire-protected area; and if this can be managed, it may perhaps be possible to cut some timber at the same time that the compartments on the south side of the Haldgadi and Shivalia Ráo are worked.

Adnala basin.

209. After the work in the Haldgadi basin has been completed, I propose that the Adnála basin should be taken in hand, and to this basin the operations of four years have at present been assigned. In this forest, a large portion of which, as already stated, is on poor soil, it will be best to limit operations to the better stocked areas on good soil, until it is seen what may be the effect of fire-protection upon the poorer and more or less stunted forests which occupy a large part of the middle slopes of this valley.

Minor basins east of the Gaujera Valley.

210. After operations in the Adnála basin have been completed, there remain the basins of several streams which join the Rámganga above the Gaujera—the head-waters of the Kclani and Bokságadi, the upper part of the Bilot basin, and the whole of the Maulia basin. These three basins have been placed last because, though they have been one year under protection from fire, the general character of the forest is not yet sufficiently advanced to justify cuttings at an earlier period.

The arrangement here proposed is elastic.

211. The above remarks will explain that the operations here assigned to a period of twelve years will probably extend over a much longer period. At the same time the arrangement is elastic also, in so far that if a large demand for timber at remunerative rates should arise, or if circumstances should make it desirable to increase fellings, the quantity cut annually may be largely increased within the limits fixed in Mr. Dansey's Report, which, for the present and until we obtain a better knowledge of the forest, should be accepted as the outside limit of the possible yield.

Selection of the trees to be cut.

212. It will now be necessary briefly to recapitulate the chief points which should be borne in mind in the selection of the trees to be cut. In all main points I agree with the proposals made in the concluding portion of Mr. Dansey's Report, from which the following is an extract :—

"No tree must be extracted, however well advanced in years, if its removal would be prejudicial for reasons of reproduction, ground, or other important particulars. Isolated trees, and trees growing on precipitous ground and narrow ridges, must not be felled on any account. An abundant reproduction of sál underneath can alone, in the generality of cases, warrant us in removing a sál tree, and then only if more light is actually required by the young growth. The danger of exposing the young saplings or undergrowth to frosts will also here be fully borne in mind."

The suggestions submitted in the present Report may be summarised as follows :—

The trees to be cut must be selected solely with reference to the reproduction of sál and to the protection of the soil on narrow ridges and precipitous slopes. As a rule, no trees below 6 feet in girth should be cut, smaller trees being cut in exceptional cases, when the reproduction of sál will be promoted by their removal and when there is ground to believe that such trees have attained their maturity and will not increase further.

Review of results.

213. It will now be well briefly to review the result of the present proposals, and to compare with them the proposals which have been submitted in another part of this Report regarding the timber operations in East and West Kumaun.

The total area of sál forest in all the forest blocks of the present Garhwál Division may be estimated at 175,000 acres. A large portion of this area is not protected against fire, nor is any special protection of it contemplated. Only about 70,000 acres are proposed to be thus protected, and to this area has at present been assigned a yield of 50,000 cubic feet per annum. The area of the sál forests of Western Kumaun has been estimated at 80,000 acres, nearly the whole of which has been under fire-protection for the last five years, and the yield of this area during the next period has been assumed at only 30,000 cubic feet. At first sight the yield proposed for the Western Kumaun Forests appears out of all proportion small, but it must be remembered that this area contains hardly any forests of mature timber, such as those in the North Pátli Dún Range. The sál forests in the valleys of Eastern Kumaun are estimated to comprise 96,000 acres, and from these it is at present proposed to extract 50,000 cubic feet annually. Compared with Western Kumaun, and considering that fire-protection has not even been commenced in the Nindhaur

Forests, this appears a large quantity; but it must be remembered that the Nindhaur is an almost untouched forest, with considerable quantities of large-sized sál trees on the lower slopes of the valley.

All these proposals, however, are made on the distinct understanding that the whole of the areas named will be effectually protected against fire. At the same time it should be said that on this understanding the yield now proposed to be taken from these forests is much below the quantity which they will eventually be able to furnish without injury to their future prospects.

The total area of sál forests in the Garhwál and Kumaun Divisions which it is proposed to protect against fire amounts to 236,000 acres*; and the total yield expected from this large area during the next period is only 130,000 cubic feet per annum. After these forests have been brought into a complete state of productiveness, they ought to be capable of yielding at the rate of at least five cubic feet per acre per annum on an average, taking into account that a large portion of the area has poor soil, is badly stocked, and cannot be expected to produce valuable timber, while a large portion of the area will yield a much larger quantity.

Nevertheless, it is, in my opinion, absolutely necessary, for the first few years at least and until fire-protection has become completely established, so that the risk from fire in future is reduced to a minimum, to maintain the very low rate of annual yield proposed in the present Report.

Cutting of other trees.

214. Simultaneously with the cutting of green sál on the areas assigned to each year's operations, I recommend that sain and sándan, and such other kinds as are associated with sál and are marketable, be cut.

Under existing circumstances the wood of these trees, except that of sándan, has hardly any market value in the hills of the North Pátli Dún. Operations on account of Government are now being carried on in the Kohtri Dún to supply about 25,000 cubic feet of sain timber in scantling, from 10 to 15 feet in length, to be delivered at Saneh at rates varying from 10 annas 10 pies to 12 annas per cubic foot. Similar operations have been made in former years, on a smaller scale and with varying success, in the Kohtri Dún and in the forests west of Kotdwára. But there are indications of a larger demand arising for sain and other kinds; and, based upon these indications, I submit the proposal that, simultaneously with the cuttings of sál in the areas assigned to each year's operations, purchasers be permitted to cut and remove trees of sain and other kinds marked by Government officers. The rate to be paid per cubic foot should be fixed, as an experiment and for these limited areas only, sufficiently low to make it worth while for purchasers to come forward.

Required in certain cases to make room for Sal.

215. With regard to this subject, it must be borne in mind that, in the better class of sál forests, the sál tree predominates, and that as a rule in such forests there is very little risk of the ground being taken up by the young growth of other kinds to the exclusion of sál.

	Area, in acres.	Annual yield of sál, in cubic feet.
* Kumaun, East—		
Sál forest	96,000	50,000
Kumaun, West—		
Sál forest, protected from fire	70,000	30,000
Garhwál—		
Sál forest, proposed to be protected from fir	70,000	50,000
Total ...	236,000	130,000

This is the general rule, but there are notable and very important exceptions to this rule. Along the banks of streams on clayey soil, and on moist slopes with a northerly aspect, sain often predominates, and in such places the reproduction of sál will certainly be favoured by cutting a portion of the large sain trees.

No special rules regarding the selection of sain for cutting, beyond what has here been stated, seem to be required. Should hereafter the demand for this and other timber in the North Pátli Dún Forest increase very largely, it will be time enough to consider such rules. For the present it will be sufficient, as suggested in this Report, to subordinate all other considerations to the question whether the growth of young sál will be promoted by the cutting of other trees or not.

Cutting out of trees of other kinds in the South Patli Dun.

216. As soon as experience has shown that sain and trees of other kinds find a market, although at low rates, it will be time to commence felling them for export in the lower and better portions of the South Pátli Dún Forest, the necessity for which operation strongly impressed itself on my mind during my visit in 1875. In those portions of the South Pátli Dún Forest where saplings and young poles of sál are abundant, there are numerous trees of other kinds, with irregularly shaped and spreading crowns, which impede the development of the young forest of sál poles. As soon as there is a prospect of getting purchasers to take such wood, I would advocate their removal; and I have mentioned this subject in this place, because the carrying out of this suggestion must depend upon the success obtained in the disposal of wood of other kinds, simultaneously with the cuttings of sál in the North Pátli Dún Forest. The experimental sale of these woods, at low rates, should be confined to certain localities, and we should guard against committing ourselves to the continuance of these low rates for the whole area of the Garhwál Forests.

Sándan, as already remarked, has a considerable market value, and I see no objection to the cutting of a certain number of marketable sándan trees within the area assigned to each year's operations at the same time that the cuttings of sál are made.

Removal of dry and fallen Sal timber.

217. A few words should here be said regarding the arrangements under which dry and fallen sál timber should be removed from the North Pátli Dún Forest. A suggestion has been made in Mr. Dansey's Report to localise the extraction of dry sál, by confining it to certain blocks which should be worked in rotation. The arguments in favour of this proposal deserve careful consideration. Mr. Dansey urges that by limiting the area which will be opened each year for the removal of dry timber, exporters will be induced to economise the wood and to abandon the present practice, which in many cases leads to waste. He also urges that exporters who have the run of the whole forests only take out the best pieces, and that trees are often cut up without due regard to economy of timber; hence he concludes that if the dry timber operations were confined to a limited area, it might be possible to permit their continuance in fire-protected blocks beyond the limit of time at present fixed, which is at the commencement of the hot season.

During the safe season the whole of the forest should, as a rule, be open for the extraction of dry fallen timber.

218. I am of opinion that this must be left an open question. In forests protected from fire it may, in some cases, be found convenient to confine these operations to a limited area, and to extend them to the whole of the dry season; but I do not advocate to open one block only at a time, as a rule, for the extraction of dry timber. I am strongly of opinion that the operations of the exporters of dry timber serve in many cases as an excellent preparation for the Government timber operations. The people

who search the forests for dry timber are the pioneers of larger timber operations; they explore the forests, and contribute much towards opening them out. As a rule, therefore, I advocate that the present system be continued, under which the whole of the forest is open to the extraction of dry timber.

Creepers to be cut simultaneously with timber operations.

219. In those areas which have been assigned to each year's operations, I am of opinion that, besides protection from fire, it will be well, simultaneously with the timber operations, to arrange for the cutting of all creepers—an operation most necessary in many places, which will doubtless be attended with great benefit. Arrangements should also be made, if possible, for the gradual cutting of creepers in those compartments to which the timber operations of the next period are not expected to extend.

Palain Range.

220. The Palain Range occupies an area of 40,960 acres, of which it is supposed that about 30,000 acres contain sál. It comprises the west side of the Palain River, below its junction with the Haldgadi, part of the valley of the last named river, the head-waters of the Palain, the Kansúr, and the Mandálti; and is bounded on the south by the high ridge which separates the valleys of the Sona Nadi and the Mandálti. Of the north edge of this block a strip, on an average two miles wide, is open to pasture and the exercise of other rights of the adjoining villages in the hills.

The Mandálti Valley has quite the character of a valley in the Siwálik Hills. The rock is mostly a soft sandstone, and the soil is very loose and suitable for the growth of sál. The lower part of this valley is exceedingly valuable; it consists of a succession of flats and terraces, with groups of tall well grown poles of sál, and although at present the reproduction of that tree is impeded by the annual fires, it will, if fires are excluded, be extremely valuable. A peculiar feature of the Mandálti is the large number of túnˌtrees of all ages, and this tree wherever found in this district should be most carefully protected.

The Haldgadi has already been mentioned, and it has been explained that the whole of this valley will probably be eventually annexed to the North Pátli Dún Range.

The Kansúr is different in character from the Mandálti; there are terraces and large and extensive flats along the lower part of its course, with numerous middle-sized and large sál trees and a considerable area of pole forest. In the upper part of the valley the forest is more mixed. On the north face of the Siddhká Dánda (the ridge which separates the Kansúr from the Mandálti Valley) there is a considerable area of sál forest at the heads of the side valleys, but the trees are not of large size. The head of the Palain Valley is chiefly of importance for the large extent of bamboo forest, and there are numerous tún trees along one of its eastern feeders.

As far as the growth of sál is concerned, it must be borne in mind that frost is extremely severe in the Kansúr Valley. This is the chief drawback. Otherwise these forests are most valuable, and the lower part of this valley, as well as the lower part of the Mandálti and the whole of the Haldgadi basin, merits early consideration in the matter of fire-protection. There is a large extent of gentle slope and level ground with good deep soil in the lower part of these valleys, which will benefit much more rapidly by fire-protection than the hills of the North Pátli Dún Range.

Kohtri Dun Range.

221. This range occupies an area of 42,880 acres, of which it is estimated that 30,000 acres contain sál.

The head-waters of the Kohtri River rise in the same hills as the head-waters of the Kansúr. The head-waters of the Chokhamb meet those of the

Mandálti, while another feeder, the Gagás, takes its rise from a point near the head-waters of the Sona Nadi. On the north side of the valley there are several other large feeders, the most important of which is the Ganjgád.

The lower part of this range is situated in the outer Siwáliks, while the upper part extends to the higher hills. The Kohtri Dún Range has yielded a very large quantity of sál timber, and is easily accessible by a good cart-road up to the head of the valley. At the head-waters of the Kohtri River are large areas of nearly pure sál forests, at an elevation of from 2,500 to 4,000 feet—the highest point within forest limits.* The sál growing on these hills is mostly stunted, and never attains any great diameter; but it has nevertheless yielded large quantities of timber in the shape of scantling and sleepers. The lower part of the valley and its feeders, however, have produced timber of very large size, and a remarkable place is the Chokhamb Dún, an undulating plateau, above 2,000 feet, containing the remains of excellent forests which formerly covered it. I am informed that a great part of the Chokhamb Forest is now so well stocked as to be safe from fire without special protection, and that the natural reproduction of sál in this place is very good. In his Report for 1865-66, Mr. R. Thompson mentions a very large number of mature trees at the head-waters of the Ganjgád, but most of these trees have since been cut.

Export of green Sal timber.

222. The following statement gives an account of the green sál timber cut and exported from the Garhwál Forest Division during the ten years ending with 1880-81. It will be noticed that by far the greater proportion of this timber was exported in scantling, and that a small quantity only was exported in the shape of logs. It will also be noticed that the great majority of this timber was exported by Government, and a small quantity only, in 1880-81, by merchants.

Statement of green Sál timber cut and exported from the Garhwál Forest Division from 1871-72 *to* 1880-81.

Years.	Compartments.		Timber cut.			Scantlings cut and exported.		Remarks.
			Trees.	Logs.				
				No.	Cubic contents.	No.	Cubic contents.	
1871-72 ...	Mandálti ...	Kohtri Dún.	1,098	227	2,965	*30,137	15,046	* The cubic contents of 18,852 pieces not known.
1872-73 ...	Ditto ...		2,540	...	...	†51,359	18,075	† Ditto of 37,803 ditto.
1873-74 ...	Basikhand ...		278	...	...	‡45,023	59,611	‡ Ditto of 8,686 ditto.
1874-75 ...	Kuribari and Burkhet.		345	...	...	§12,130	14,297	§ Ditto of 2,513 ditto.
1875-76 ...	Bhakwa ... 147 Dhikala ... 5,152	Pátli Dún.	5,299	...	...	76,238	150,557	Exported by Government.
1876-77 ...	Mainagari ...		214	3	36	6,824	11,683	
1877-78 ...	... ...		...	...	...	...	...	
1878-79 ...	Goujpani ... 630 Pipalsati ... 700 Jalikhand ... 221		1,551	...	...	17,387	25,983	
	Domunda ...		16	...	...	...	...	
1879-80 ...	... ...		...	...	...	...	...	
1880-81 ...	Gaujera ...		161	46	1,281	2,759	2,947	Exported by Merchants.

* Sál is found, although poor and stunted, up to an elevation of 5,200 feet in the Garhwál Hills.

Bamboos.

223. The bamboo (*Dendrocalamus strictus*) forms one of the most important articles of export from the Garhwál Forests. The quantity exported annually during the last ten years appears from the statement appended to this Report as Appendix VII, drawn up by the local officers. But although the bamboo forests which furnish this yield are very extensive, there is good ground for believing that the supply is deteriorating. The great mass of the bamboos brought to the depôts at the present time are exceedingly small, and have been so for several years past. In this respect I have noticed a considerable difference on my three successive visits to these forests. In 1863 the bamboos extracted were, as a rule, larger than those which I saw on my visit in 1875, and on the occasion of my present visit I have again noticed a marked deterioration. And apparently there has also been a decrease in quantity. The following abstract shows that during the five years ending with 1875-76 the quantity exported averaged 1,000,000 scores, while during the five years ending with 1880-81 it was only 650,000 scores:—

	Bamboos exported from the Garhwal Forests since 1871-72.		
	Scores.	Revenue realized.	Rate per 100 scores.
		Rs.	Rs.
1871-72	914,000	59,000	6·5
1872-73	1,298,000	83,000	6·4
1873-74	997,000	64,000	6·4
1874-75	823,000	53,000	6·4
1875-76	1,072,000	68,000	6·3
Average of 5 years ...	1,020,800	65,400	
1876-77	855,000	55,000	6·4
1877-78	717,000	47,000	6·5
1878-79	317,000	22,000	6·9
1879-80	630,000	45,000	7·1
1880-81	725,000	51,000	7·0
Average of 5 years ...	648,800	44,000	

The bamboo clumps are overcut.

224. The point is this, that if bamboo clumps are cut moderately the young shoots, which are produced in July, August, and September, attain their full size. But if a clump is overcut, that is, if a sufficient number of old stems are not left standing, the fresh shoots produced are short and thin. The conclusion to which my long experience of bamboos has led me is that, unless there are a large number of vigorous stems with full foliage in a clump, the plant as a rule has not sufficient strength to produce a crop of full-sized young stems. Indeed, if too many of the old stems are cut out, the young growth consists of masses of thin slender branches similar to grass.

Bamboo forests in the more remote valleys.

225. In 1875 I came to the conclusion that in all the more accessible valleys the bamboos have been much overcut, and to this circumstance I then chiefly ascribed the small size of the bamboos exported, which on that visit attracted my attention. Only in remote valleys, such as the Kansúr and Haldgadi, did I see bamboo clumps with stems of the full size ordinarily attained by this species in North-Western India. In such places the bamboo forests consisted of well stocked clumps, with stems 40 feet long and 3 inches

in girth. On my present visit I found that in the Kansúr Valley also the bamboo forests had been overcut. The unfavourable appearance of these forests on the occasion of my present visit must, to some extent, be ascribed to the circumstance that the bamboos had flowered to a very large extent. As is well known, this species does not generally flower gregariously. A few stems in a clump, or a few clumps in a forest, flower and seed. Since 1870, however, the bamboos over large areas have seeded, and there was an extensive flowering in 1877-78 in the Palain and Kansúr Valleys; hence the numerous clumps which have not yet attained full size. Apart from this, however, most of the older clumps, in the different parts of the forest visited by me had been overcut, and the shoots produced during last rains had not attained the size which I should have expected to see.

Conservator's opinion.

226. I ought, however, to mention that the Conservator, Mr. Greig, is of opinion that the bamboos in Garhwál have not been overcut, and that they have not deteriorated since he has known these forests. Mr. Greig thinks that in out-of-the-way places and at the heads of ravines and valleys there is still a very large number of vigorous clumps, and that there is no likelihood of the supply of good bamboos being insufficient to meet the demand. I have also been assured by the local officers that the fluctuations in the demand from year to year are so great, that the decrease in the quantity exported during years when the demand is slack is sufficient to establish a kind of rotation, the bamboo clumps enjoying comparative rest during those years of diminished demand.

The North Patli Dun Forest to be closed against the cutting of bamboos.

227. Mr. Greig concurs, however, in my suggestion to close the North Pátli Dún Range, as far as it was included in Mr. Dansey's valuation surveys, against the cutting of bamboos for a number of years, as an experiment. The closing of the bamboo forests outside the Siwáliks, in the Saháranpur District, has had most beneficial results; and I feel convinced that the protection against cutting of these forests will have the effect of greatly improving the quality of the bamboos produced, and that, if this measure is duly carried out, the North Pátli Dún Range will prove to be a most important bamboo reserve. After the bamboos in this range have had sufficient rest, the working should be arranged in rotation by blocks, so as to guard against excessive cutting. In this range then the bamboos will profit both by protection from fire and by protection against cutting.

Large proportion of young shoots extracted.

228. A remarkable feature in the bamboo export trade from these forests is that a large proportion of the bamboos extracted consists of young shoots less than one year old. For certain purposes, such as the manufacture of mats and baskets, young stems are necessary. But for building purposes they are much less durable than stems which have fully matured and hardened; and I am disposed to think that the reason why so large a proportion of young shoots are cut is that no old ones of good quality are available, and that when, after a few years' rest, the closed forests are opened for cutting, a much larger proportion of old, properly matured, and hardened stems will be available for export.

Revenue on produce removed by purchasers.

229. The following statement exhibits the revenue realized on produce removed from the old Garhwál Division, including the forests now comprised within the Ganges Division. Two points merit notice in this statement. The export of khair timber shows a tendency to decrease, and this is in accordance with what is known regarding the state of the growing stock of khair timber in the forests. The export of other timber (not sál), on the other hand, has increased largely, and this is a satisfactory indication of the increasing demand for such woods.

Revenue realized on produce removed by purchasers from the (old) Garhwál Division in 1877-78, 1878-79, 1879-80, *and* 1880-81.

Budget heads.	Old Garhwál, 1877-78.	Old Garhwál, 1878-79.	Old Garhwal, 1879-80.			Old Garhwal, 1880-81.		
			Garhwál.	Ganges.	Total, old Garhwál.	Garhwál.	Ganges.	Total, old Garhwál.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
A.—Timber—								
1. Sál, dry or fallen	24,791 2 2	17,345 6 9	19,833 0 0	1,081 9 0	20,914 9 0	32,319 3 11	5,640 15 6	37,960 3 5
2. Khair	684 12 0	11,232 0 0	4,330 0 0	38 10 4	4,368 10 4	2,835 8 6	18 10 0	2,854 2 6
3. Sissoo	302 8 8	253 2 10	265 0 0	22 9 2	287 9 2	230 11 3	229 9 7	460 4 10
4. Other timber	3,060 8 3	2,907 7 5	2,514 15 0	2,722 11 11	5,237 10 11	4,035 10 2	7,019 9 0	11,055 3 2
B.—Firewood and Charcoal	548 13 10	954 12 5	259 11 9	211 15 6	471 11 3	322 0 0	339 3 9	661 3 9
C.—Bamboos	47,295 5 9	21,634 12 5	33,162 4 11	11,501 5 11	44,663 10 10	25,511 12 10	25,496 8 2	51,008 5 0
D.—Grazing	2,546 2 8	2,324 9 6	1,591 6 0	641 14 4	2,233 4 4	2,265 4 8	998 5 7	3,263 10 3
E.—Other minor produce—								
1. Grass, including bhabar	1,236 4 7	1,803 1 3	1,905 5 2	105 11 6	2,011 0 8	2,591 6 11	225 6 6	2,816 13 5
2. Other items	4,310 11 8	2,542 12 5	2,510 10 4	991 6 1	3,502 0 5	1,990 7 4	1,914 4 1	3,904 11 5
	84,776 5 7	60,998 1 0	66,372 5 2	17,317 13 9	83,690 2 11	72,102 1 7	41,882 8 2	1,13,984 9 9

Receipts and Charges. Local Staff.

230. The following figures show the receipts and charges on account of the (old) Garhwál Division, including the forests of the Ganges Division, during the last three years, during which period the receipts have increased from Rs. 1,32,000 to Rs. 1,70,000:—

Statement showing the total Receipts and Charges of the (old) Garhwál Division, during the years 1878-79, 1879-80, *and* 1880-81.

Particulars.	1878-79.	1879-80.			1880-81.		
		Garhwál.	Ganges.	Total, old Garhwál.	Garhwál.	Ganges.	Total, old Garhwál.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Receipts	1,31,875 4 6	1,01,224 12 0	43,888 0 0	1,45,112 12 0	1,12,057 11 7	57,869 0 0	1,69,926 11 7
Charges	56,549 2 11	66,057 2 7	5,766 0 0	71,823 2 7	46,723 8 6	15,109 0 0	61,832 8 6

The Conservator recommends the following establishment of Rangers and Foresters for the present Garhwál Division:—

Rangers.	Foresters.	Remarks.
1 on Rs. 100. Whole forest.	2 on Rs. 30 } Dhárón, Sona Nadi, South Pátli Dún, North Pátli Dún, Palain, Kohtri Dún, and Rehar Ranges.	Rangers sanctioned—1 permanent on Rs. 70. Foresters sanctioned—3 on Rs. 25, 3 on Rs. 20, 1 on Rs. 17, and 5 on Rs. 15; 1 temporary on Rs. 25 with Forest Treasurer.
1 „ 50. Roads.	3 „ 20 }	
1 „ 60. Superintendent, Kham Táhsil.	2 „ 15 }	
	1 „ 30 Timber.	
	1 „ 20 Depôt.	
	2 „ 30 Deputy Superintendents, Kham Táhsil.	
	1 „ 15 Writer with Head Ranger.	
	1 „ 15 „ with Superintendent, Kham Táhsil.	

Retrospect.

231. Taking a brief retrospect of the different ranges which constitute the Garhwál Forest Division, it will be noticed that it is contemplated to protect against fire three of them, *viz.*, the Rehar, South Pátli Dún, and North Pátli Dún Ranges, together with a small portion, the Shishamkhata tract, of the Sona Nadi Range, and that for the present no special protection is contemplated in the Dhárón and the remainder of the Sona Nadi Ranges. In the two remaining ranges, the Palain and Kohtri Dún, there are large areas of forest which would well repay special protection, and this work should be undertaken as soon as fire-protection in the ranges first taken in hand has been firmly established.

Grass lands how to be utilized.

232. After fire-protection has thus been extended over all the really valuable portions of the division, it will then be time to consider how the large areas of grass-land, which can never produce sál, may best be utilized. Some of these lands might be planted up with khair and sissoo, but I am disposed to think that it would be better whenever practicable to lease them out for cultivation on short terms. I do not advocate that immediate steps be taken for the establishment of villages in the Pátli Dún. This must be attempted after the forests adjoining it have so changed in character that the work of fire-protection is no longer exposed to those risks to which it is subject at present. But eventually I feel assured that it will in every way be a good plan to assign defined areas in the Pátli Dún and in other suitable localities

to cultivation. The establishment of villages in these forests will enable the local forest officers to live on the spot with greater comfort, and it will be very desirable that the local officers themselves should eventually have fields assigned to them in order to give them a greater interest in the locality. The fact that the whole of the Garhwál Forests, except a narrow strip on the inner edge, are now without any villages in them, has to a great extent facilitated protection, although in the matter of fire-protection the efforts made have not hitherto been attended with much success. When the time comes to establish fields again on those lands which are unfit for the growth of timber, and which were formerly occupied by cultivation, the greatest care must be taken to assign to them well defined grazing grounds, and to prevent encroachment and the growth of rights, which may interfere with the protection of the forest.

As soon as fire-protection is firmly established, these forests will furnish an immense quantity of wood and timber, and give employment to large and steadily increasing numbers of men and cattle. The local officers assure me that at the present time the chief obstacle to increasing the export of dry sál and of other timber on a large scale consists in the small number of people who engage in the business of extracting timber from these wild forests. As soon as fields have been established, with a settled population, the number of people ready to engage in timber operations will doubtless increase largely.

Forest Rest-houses.

233. A most important point remains, and this is the provision of substantial rest-houses for officers and subordinates employed in these forests. The progress made in their condition, which is due almost entirely to the protection against promiscuous cutting, gives me the assurance that this progress will be very considerable as soon as fire-protection is begun in earnest, and that the revenue will increase largely. And it seems to be time now to establish permanent head-quarters for the Divisional Officer and for the Rangers in these forests.

The most central position is Dhikálá, on the Boksár-Barsoti road, a quarter of a mile distant from the Rámganga River, and this has been selected as the best place for erecting a first class (double-storied) rest-house. A second class house is proposed to be built at Kálágarh, a timber depôt and the largest revenue station in the division, situated at the point where the Rámganga leaves the hills.

Besides these, third class rest-houses are proposed to be built in the following ranges :—

Dháron	3	third class	rest-houses.
Sona Nadi	2	„	„
South Pátli Dún...	1	„	„
North „ „	2	„	„
Palain	2	„	„
Kohtri Dún	2	„	„
Total ...	12	„	„

The following is an abstract of the cost of these buildings :—

		Rs.
1 first class rest-house, at Rs.	3,500	3,500
1 second „ „ „	2,600	2,600
12 third „ „ „	550	6,600
Total		12,700

Spread over ten years, as in Kumaun, this would amount to an annual outlay of Rs. 1,270. If funds can be made available, I would recommend that this work be completed sooner, as it is of the utmost importance to afford good accommodation to officers and subordinates in the Garhwál Forests.

CHAPTER VIII.

GANGES DIVISION.

234. This division comprises, besides the leased Bhágirathi Forests of the Tiri State and 90,560 acres at the foot of the hills in Garhwál, extending from Kotdwára to the Hiul River above Lachman-jhula, an area in the Bijnor District, called the Chandi Forest, on the left bank of the Ganges, measuring 20,882 acres. In this area is not included the southern part of the Chandi Forest (18,497 acres), which is at present in charge of the Collector of Bijnor, whose accounts for these forests are not rendered to the Ganges, but to the Garhwál Division.

Chandi Forest.

235. The Chandi Forest is an outlying stretch of hills of the outer Siwálik formation, the highest point of which rises to 1,913 feet.

In 1867 this forest was made over to the Roorkee Workshops for the supply of timber, wood, and charcoal. The arrangement stipulated that the workshops might sell minor forest produce, but no wood or charcoal. Since that time the cuttings, chiefly for charcoal, have been continued, except in the north-west corner, where a certain area has been left uncut. The cuttings have generally extended up the valleys and ravines, and have nowhere reached the higher slopes of the hills. The result is that the lower portions of the Chandi Hills, as far as cuttings have extended, are almost bare.

Fires have never been kept out, and hence, where cuttings have been made, the ground is now chiefly stocked with grass. There are, however, stumps and coppice-shoots, and probably a large number of root-stocks in the ground; so that, if the forest were protected from fire, it is probable that a large portion would get restocked with trees and brushwood, but, except in the valleys and on some flats, no large timber can ever be expected to grow in these forests.

The tops of the hills, however, and the higher ranges were not cut over at all, and here the forest, such as it is, is still in its original condition; the chief trees on the ridges and higher slopes being katbhiláwa *(Buchanania latifolia)* and bákli (*Anogeissus latifolia*), with a varying proportion of sál. The soil is gravelly, full of large boulders, and generally dry and very poor.

Management transferred to Forest Department.

236. No complete information is available regarding the quantity of wood and charcoal which the Chandi Forest has yielded during the period it was held by the Roorkee Workshops. On representations by the Conservator to the effect that the forest was being destroyed and no proper measures taken for its conservancy, its management was, in November 1880, transferred to the Forest Department, and the area was included in the Ganges Division.

Hazara Bagh.

237. The most valuable part of the Chandi Forest is the Hazara Bagh, a flat measuring about 2,000 acres, of which about 1,500 acres are stocked with miscellaneous forest, mixed with scattered sál and bamboo, and enclosing some grass lands. At present the young growth of sál is only in patches, but the place will produce a large crop of small poles, which will find a ready sale for the Ganges Canal Works. The soil of this flat is, however, extremely poor, and the trees are short and stunted. Fire-protection will doubtless improve the surface-soil, but cannot be expected to change the sub-soil, which will probably be found to consist of a mass of boulders.

Hills above Hardwar more denuded than Chandi.

238. A glance at the Chandi Forest and the hills opposite, on the right bank of the river above Hardwár, shows that the latter have been much more heavily worked and are nearly denuded, the reason being that these hills are easily accessible from Hardwár and have thus been more largely drawn upon to supply local requirements.

The charcoal for the workshops from the northern part of Chandi is at present carted round *viâ* Peli, so as to cross the river by the bridge of boats at Shishamghat. This is done in order to allow the charcoal to go without break of bulk to Roorkee, but the produce of the Hazara flat and the adjoining part of the Chandi Forest might equally well be exported by the Ganges Canal.

Protection from fire.

239. Arrangements for protecting the Hazara flat from fire during the present hot season have been made, and it will perhaps be possible, after protection has here been successfully continued, to extend the protected area over a portion of the hills at the back of the flat. I myself should be disposed to advocate the protection of the upper part of the Chandi Forest north of the Chandi Temple. The annual fires must eventually destroy a large proportion of the vegetable growth, which still remains in and on the ground in those places to which the charcoal operations of the Roorkee Workshops have extended. It may be urged that the forest is of an inferior character, and that it will never repay conservancy. This, however, can hardly be the case: the ravines and many of the slopes are full of bamboos, which yield a considerable revenue; and although the sál, which is common over a great part of the northern portion, will never attain a very large size, yet small sál poles will always command a ready market at this place. I have no doubt that the bamboos, which are not very large at present, would greatly increase in size if fires were kept out.

Under these circumstances, I would recommend that a few years hence, but not too late, the fire conservancy of the northern part be taken in hand. It would probably also be a good plan, simultaneously with fire-protection, to close this portion against the cutting of bamboos for two or three years, to enable the bamboo clumps to derive the full benefit from immunity from fire.

Gori Range.

240. This range comprises the forests between the Rawásan River, which leaves the hills at Láldhang, and the Ganges. Near the inner and upper boundary the hills rise to an elevation of 4,500 feet, and send down to the Ganges spurs with precipitous sides, which are separated by steep, narrow valleys and gorges. At the foot of the hills, near the Ganges, there are limited areas of more gentle slopes, with good soil, and there are a few valleys of flat ground stocked with grass and shisham, of which the Mundál is one of the largest.

Sal forest.

241. The most valuable portions of this range are five sál forests of limited area, viz.,—

(1.) The Koria Forest, about 600 acres, well stocked with saplings and poles, chiefly sál, and with a few large hollow trees.

(2.) Patirána, near the head-waters of the Dogadda Sot in the hills, 1,500 acres, with a good deal of young sál coming up on the sites of deserted fields, and some mature trees in the ravines.

(3.) The Jogichaur Forest, between Gháziram Sot and the Mundál Valley, 1,500 acres.

(4.) The Luni Forest, on a flat between the Luni and Sarkara Sots, estimated to cover 300 acres, on good soil, stocked with tall, well grown poles.

(5.) The Láldhang Forest, on undulating ground at the foot of the hills, between the Rawásan and Luni Sots, of about the same extent.

There are numerous other sál forests of small extent; and generally it may be said that sál occurs wherever dry open slopes are found. I am inclined to ascribe the absence of extensive sál forests in this part of the outer hills to the fact that there is a high range, rising to 4,000 feet, which, in a straight line, is not more than five miles distant from the foot of the hills. Hence the valleys are mostly deep, narrow, and moist, and hence the scarcity of sál.

Although these sál forests do not contain many large trees at present, the growth of the poles in them is very good, and there is no reason to believe but that many of them will attain to large timber. In no other sál forests have I seen such extensive damage done by wild elephants as in these isolated stretches of sál forest in the Ganges Division. Large numbers of poles, up to three feet in girth, are thrown down by them every year.

Other trees.

242. Besides sál, khair, sándan, tún, kúsamb, and shisham are found, but nowhere in large quantities. Some very extensive tracts of shisham poles, near the Ganges, were washed away in the flood of September 1880.

These, however, are not the only marketable woods, there being a great demand for many other kinds—sain, jáman, haldu, kaim,* amaltás, dhaura, bákli, bahera, jigna. There is also a demand for simal floats for heavier woods on the banks of the Ganges; indeed, this year (1881) I was informed that there was a demand for every kind of wood, provided it is large enough to be sawn up into karris. It is quite possible that this demand may continue, and in this respect the forests near the Ganges are in an entirely different and much more favourable position than those of the Kumaun and Garhwál Divisions.

Fire-protection.

243. In the Gori Range arrangements have been made to protect from fire the following areas:—

First.—The Koria Forest, comprising the lower slopes of the hills between the Dogadda and Bhinj Rivers, estimated to measure 3,000 acres, of which 600 acres are stocked with poles of sál. The protection of this forest was attempted some seven or eight years ago, but failed.

Second.—The Jogichaur Forest, a flat on the Ganges between the Mundál and the Gháziram Sots, estimated to measure 1,500 acres, which are stocked with sál. This flat has excellent soil, a deep light loam. The forest has been worked very heavily in former years, and only hollow and useless trees remain, in addition to groups of poles; but the poles are tall and straight, and the ground under grass is in most places well stocked with young growth. The difference in the character of this and the adjoining forest of Hazara Bagh is exceedingly remarkable, and it will, if fire-protection be continued, grow into an extremely valuable forest. Considering that there is a certain demand for woods of other kinds, it is of course important to extend fire-protection over a larger area, and the Conservator is of opinion that the whole area which faces the Ganges north of the Mundál Valley can gradually be brought under protection without causing either hardship or discontent. The Mundál and Dogadda Valleys would probably be left open as grazing grounds. Regarding

* Haldu and kaim are, however, much less common here than further east.

the line which should be chosen as the inner or eastern boundary of this protected block, nothing can be said at present; this must chiefly depend on the possibility of making a bridle-path across the hills from north to south. The areas along the upper boundary which are open to the exercise of village rights may be excluded. If fire-protection is extended so far, it will probably be necessary, here as in other divisions, to close the forests against exporters at the beginning of the hot season ; but it is hoped that this will not sensibly affect the revenue.

Certain bamboo forests to be closed.

244. In order to improve the size of the bamboos exported from these forests, I recommend that for a period of two or three years, or as long as may be found necessary, a limited area of bamboo forest, say the basin of one valley, be closed against bamboo cutting. Here, as in the bamboo reserve of the Pátli Dún, this measure must be regarded as an experiment, the effect of which must be watched from year to year.

Udepur Range.

245. This range extends from the Kho to the Rawásan River, and comprises the outer hills and a narrow belt on level ground between the Séli Sot and Láldhang. On the inner or northern boundary the hills attain an elevation of nearly 4,000 feet. The greater part of the ground is precipitous, the valleys and ravines very narrow, and the best forest is in flats and on more gentle slopes near the base of the hills. Sál is found scattered wherever the slope is more gentle in the outer hills of the range, but the only area of considerable extent is the Sakhrao sál forest, which is estimated to measure about 600 acres. There is a great deal of bamboo, and in the hills bákli is the principal tree, and there is a considerable amount of sain in the valleys and ravines.

The belt of level ground outside the hills is chiefly grass land, with scattered trees of haldu, bahera, chila, and khair in places. Bael *(Ægle Marmelos)* and rohni are also common. The well known bamboo forest in the plain north-west of Haldukháta is not included in forest limits.

The demand for other kinds of timber is not so great as in the Gori Range, on account of the greater distance of the Ganges ; but the local officers believe that there would be no difficulty in selling whatever timber might be cut of sain, jáman, and haldu.

Papidanda protected block.

246. South of the Sigadi Sot, near the revenue station of Pápidánda, an area of about 500 acres on level ground outside the hills has been protected against fire during the hot season of 1880, the attempts to protect it in previous years having been unsuccessful. The grass is now very heavy, and among it here and there is a considerable quantity of khair. The other kinds of trees are, however, short and rather stunted, and I am not sure that the soil is favourable. The idea in closing this piece was, I understand, to increase the supply of khair. Natural reproduction of khair will not suffice to secure this object, and hence it will be necessary to plant and sow this tree. For this purpose I recommend that lines 30 feet apart be taken in hand. Along the lines the ground should be dug and heaped up in a flat continuous ridge, about 18 inches broad at the base, and this ridge should be thickly sown with khair seed, so as to ensure continuous lines of this tree. This operation must only be regarded as an experiment, to be made on a limited scale.

The expense of protecting this small area is, as a matter of course, out of all proportion to the advantage expected to be obtained thereby, and it is most desirable that at this place the fire-protected area be extended, for it would not be right to recede from the position taken up and to abandon this small plot. The level ground to the north-west of the Sigadi Sot is occupied by large numbers of cattle, and it is believed that no extension in that direction is at

present feasible; but it should be considered whether the area may be extended to the east and into the outer hills, which are here fairly well stocked with forest of miscellaneous growth.

Yield of Ganges Division.

247. In this, as in the Kumaun and Garhwál Divisions, the rule obtains that no green timber is to be cut and removed by purchasers (except khair for pestles), save in special cases on special permission. In this division there is a good deal of khair on high ground which is not liable to be washed away; and, with a view to its protection, the cutting of khair has very properly been stopped during the present season. There is no doubt that the cutting and digging up by the roots of immature khair is an exceedingly wasteful process, and where, as here, khair grows on high ground, some endeavour should be made to protect it.

Regarding the quantity of dry timber removed from the Ganges Division by purchasers, information is only available for part of 1879-80 and for 1880-81—

	1879-80 (4 months). Cubic feet.	1880-81 (12 months). Cubic feet.
Sál	2,922	15,487*
Other kinds	7,431	31,115*

Most of the dry timber is removed in the shape of tors and blocks of sándan and shisham for cart building.

Green timber extracted by Government agency.

248. The following statement gives an abstract of the green timber extracted by Government agency since 1872-73 from the forests which now constitute the Ganges Division:—

Year.	Range.	Kind of tree.	Number of trees.	Cubic feet.	Remarks.
1872-73	Gori ...	Bákli	23	180	Sold in logs.
	„ ...	Sain	103	800	Ditto.
	„ ...	Different kinds ...	5,746	14,248	For canal works.
1873-74	„ ...	Shisham ...	6,497	9,528	Ditto.
	Udepur ...	Different kinds ...	938	20,920	Sent to depôt in the plains.
1875-76	Gori ...	Sain	502	10,892	Sold in logs.
	„ ...	Bákli	100	2,359	Ditto.
	„ ...	Different kinds ...	14,479	40,000	For canal works.
	„ ...	„ „ ...	7,911	12,726	On indents from timber merchants, sawn into karris.
1876-77	„ ...	Sain	2,072	65,675	Ditto ditto.
	„ ...	Different kinds ...	17,830	45,000	For canal works.
1877-78	„ ...	Sain	200	9,654	On indents from timber merchants.
	„ ...	Different kinds ...	9,496	27,126	For canal works.
1878-79	„ ...	Sain	1,461	38,984	On indents from timber merchants.
	„ ...	Different kinds ...	6,593	19,929	For canal works.
1879-80 ...	„ ...	„ „ ...	4,533	17,848	Ditto.
1880-81	„ ...	Sain	830	16,135	On indents from timber merchants.
	„ ...	Different kinds ...	170	8,038	Ditto ditto.
	„ ...	„ „ ...	13,628	41,423	For canal works.
		Total ...	93,112	401,465	

* Includes the yield of Chandi since the 1st November 1880.

Supply of timber to Ganges Canal.

249. It will be noticed that a large item in the annual yield of this division is the wood supplied to the Canal works. This wood is used for the construction of the temporary head-works, for which none but straight poles, from 10 to 30 feet in length, can be employed, but they may be of any kind of wood. After fire-protection has been successfully continued for some time, there ought to be no difficulty in supplying the quantity required for this purpose, which fluctuates between 5,000 and 20,000 pieces a year. Each piece is a young tree, and only well grown poles are used for this purpose.

The cutting out of the best shaped, and in many cases of the largest poles in the forest is not in accordance with rational Forestry; but the quantity is so small in regard to the area from which these pieces can be extracted that, under careful management, the supply of these poles should cause no inconvenience.

The forests from which the poles for the Canal may be supplied at the present rates are those situated north of the Hazara Sot, the Ghâziram Valley, and the Dehlighati Range. Of the total area, however, within these limits, which is approximately 30,000 acres, a portion only is sufficiently accessible to furnish these poles at rates remunerative to the contractor who undertakes the work.

I am of opinion that if fire conservancy is extended at an early date over the greater part of the Gori Range in the manner here suggested, it will be possible, without injury to the forests, to continue this supply; but the matter requires most careful consideration, and these operations should not be made at hap-hazard, but in accordance with a regular and carefully considered plan. So much is clear, that the protection of these forests against fire is a necessity. A point which has not here been adverted to, in regard to the timber required for the Canal works, is whether the price paid by the Canal should not be raised considerably, because at the present rates it would probably be much more profitable to allow the timber to attain a large size and then to saw it up.

Supply of timber for the Ganges Canal from the Dehra Dun Forests.

250. A considerable quantity of timber for the Canal bunds has also been supplied from the Dehra Dún Division of the School Circle, and it probably suits the convenience of the Canal Department to obtain the wood for certain of the bunds from the Dehra Dún side. But I am informed that, in consequence of the rates charged in the Ganges Division being lower than those demanded in the Dún, the Canal Officers are endeavouring to arrange for future supplies almost entirely from the left bank of the river. There is a large extent of forest on the Dehra Dún side from which timber of the required sizes could be extracted; and it is very desirable that the Conservators of the two Circles should so arrange the rates that there should be no appearance of competition between the two divisions, and that they should come to an understanding regarding the quantity of timber that should be supplied from each division. As a matter of course, in a case of this kind, the officers of the two forest divisions should act in concert, and the prices charged for the various classes of wood should be the same on both sides of the river.

Demand for other kinds of timber, not Sal.

251. As an instance of the demand which exists for timber of other kinds, I may mention that an arrangement has lately been made with some timber merchants from Meerut for the sale of 40,000 cubic feet of timber of different kinds, in scantlings of from 8 to 15 feet long, cut and delivered by the Forest Department.

The statement given above shows that as yet the annual yield of green timber has not exceeded 50,000 cubic feet from the whole of the Ganges Division, which is a small quantity considering the total area (90,560 acres); but there seems good ground for believing that the demand for all kinds of timber is increasing and may increase very largely. It is of course most desirable that these forests should meet this demand to the fullest extent which their condition permits, but of the total area a very large proportion is precipitous ground, or, for other reasons, unavailable for export; and, on considering the matter in detail, it will probably be found that the area available to supply this demand is very limited.

A plan must be drawn up to regulate fire-protection and the working of the forests.

252. The practical conclusion of these remarks is that, *first*, the existing stock of trees of marketable size must be carefully husbanded, that cuttings, not for the Canal only but generally, must in future be regulated by a regular plan of working; and that, *secondly*, in order to secure the best possible regeneration of the forest, fire-protection must be extended into all parts of this division, excluding only those portions which are required as grazing grounds, or the higher hills which are either open to the exercise of recorded rights or not available for the extraction of timber.

The plan according to which fire-protection must be gradually extended in this division will require the most careful consideration by the local officers.

Local Staff.

253. The Conservator recommends the following staff of Rangers and Foresters for this division:—

Rangers.	Foresters.	Remarks.
1 on Rs. 60—Whole forest	1 on Rs. 30 1 „ 20 } Udepur, Gori, and Chándi Ranges. 1 „ 15 1 „ 40 Superintendent, Kham Táhsil. 1 „ 30 Timber and roads. 1 „ 15 Writer with Ranger.	Rangers sanctioned.—None. Foresters sanctioned—3 permanent on Rs. 30, Rs. 25, Rs. 20: 1 temporary on Rs. 15.

CHAPTER IX.

FORESTS IN THE SAHARANPUR DISTRICT.

Organization.

254. The Saháranpur Division comprises the forests on the outer slope of the Siwálik Hills, and on ground immediately below in the eastern half of them. For administrative purposes, these forests, comprising an area of 190,696 acres, have been divided into three ranges, which for the present have been styled the Western, Central, and Eastern Ranges.

Western Range.

255. The *Western* Range, which extends from the Jumna River to the ridge west of Sukh Ráu, comprises an area of about 75,571 acres, which, with the exception of a narrow fringe along the submontane road, is all in the hills. In this range the only special work of fire-protection attempted has been to exclude fires from the Daula tract, in the Khára block, which is on the banks of the Jumna. This area (about 600 acres) is chiefly stocked with sál, growing mainly on level and gently sloping ground. Protection was commenced in 1878, and has been hitherto successful; it is effected by a broad cleared fire-line all round the area.

Central Range.

256. The *Central* Range, area about 80,040 acres, comprises the hills between the ridge west of Sukh Ráu and that west of Harnoul Ráu, together with a large extent of forest outside the hills. In this range the chief works of improvement have been commenced, *viz.*, the protection against fire of the Lakarkot and Ganjarban blocks, outside the hills and on both sides of the submontane road; and the protection of the hills drained by the feeders of the Rátmáu Nadi, which crosses the Ganges Canal at Dhanauri.

The protection of Lakarkot and Ganjarban is secured by broad exterior fire-lines, burnt to a width of 200 feet, the central portion, 20 feet wide, being entirely cleared; and by a system of interior roads, cleared completely to a width of 10 feet, the roads running downwards from the hills being so laid as to follow the configuration of the ground in order that they may be used as export lines. The submontane road is also used as an interior fire-line, a strip on either side of it being burnt annually. Lakarkot was first protected during the hot season of 1879, while the protection of Ganjarban was commenced a year later.

257. Of the hills drained by the feeders of the Rátmáu, a portion only has yet been taken in hand, the broad stony ráus being chiefly used as fire-lines. It is intended that the protected area shall extend across the Siwálik Range to the upper edge of the Bulawála protected area in Dehra Dún, but the arrangements to effect this have not been quite completed. With regard to the fire-protection of the area in the hills, we recommend that, whenever fire-lines are made, great care be taken to make these fire-lines accessible by making foot-paths alongside of them, which should, as far as possible, be made practicable for a led pony. This arrangement has been found to answer admirably in the Western Kumaun Forests. Whenever fire-lines run over difficult ground, it is found that they can only be kept clear if such foot-paths are made along them.

258. The protection of the Rátmáu basin against fire, if continued sufficiently long, will have a most beneficial effect in improving the character of the Rátmáu Nadi and preventing injury to the Ganges Canal. It may reasonably be expected that the current in this stream, which, under existing circumstances, comes down in occasional sudden flows during the monsoon, will be more uniform if the sides of the hills become more completely clothed with forest, and that the present monsoon torrent will gradually be converted into a steadily flowing stream, with a regular current during, say, six months of the year. An essential point in this arrangement is that, in order to increase the cover and to make the protection of the soil more efficient, no green timber whatsoever should be cut in any part of the Rátmáu basin during the first years of fire conservancy.

Sowings of Khair.

259. In the Central Range 25 acres were sown up with khair during the rains of 1879 and 1880. The seed was sown in land stocked with grass three to five feet high, in continuous lines ten feet apart. These lines were in some cases made with a plough, in others they were dug up with the hoe. A fair proportion of the plants is alive, but we recommend that in future the seed should be sown much more thickly. The high grass has protected the plants against sun and frost, but it has also had the effect of drawing them up, and the stems are long and slender. This, however, is probably no great disadvantage, and there seems every probability of the plants surviving. It will, however, be desirable to beat down the grass along the lines at the commencement of the rains, so as to enable the plants to make better progress during the wet season. Khair is indigenous in these blocks, and we recommend that this very instructive experiment be regularly extended by additions made every year.

In this block the Conservator proposes, as an experiment, to sow sál seed in patches, the patches being arranged in lines, and the ends of the lines being marked by piles of stones. Simultaneously with this experiment, a contiguous plot should be planted up with sál seedlings dug out in the forests—a plan which has succeeded well at the southern end of the Buxa Reserve in Bengal.

Eastern Range.

260. The Eastern Range, area about 35,085 acres, comprises the hills between the ridge west of Harnoul Ráu and the Ganges River, and includes also the islands in that river stocked with sissoo, as well as the Patri Forest.

Patri Forest.

261. On the 4th April we examined the Patri Forest, which consists of five blocks. The ground is covered with grass, with scattered groups of dhák, and a few other trees, khair being found here and there. The whole forest is at present grazed over, and as a rule it is burnt every year. A plantation was commenced by Mr. A. Campbell at Ferozepur in the northern part of the main block (No. 1) about the year 1871. The surface soil in the plantation is a light loam, with a considerable proportion of vegetable mould. This has usually been successfully protected from fire. The watering of the plants was effected by means of an irrigation cut from the Ganges Canal, and there is a well, the water in which was standing at about 14 feet from the surface at the time of our visit. At first a large variety of seeds were sown, of which sissoo only succeeded on a large scale, and the result is now a young forest of sissoo, with a small proportion of other kinds, of which may be mentioned the tallow tree *(Excœcaria sebifera)*, *Acacia Farnesiana*, *Albizzia procera*, and *Acacia Lebbek*. There is also a small patch of tún and a plantation of *Albizzia stipulata* near the forest house. Sál, sain, jáman, bahera, kikar, khair, teak, and farás were also tried. The shoots of sál are cut down annually by the frost, but a number of the plants are alive.

262. The area planted consists of 18 plots, aggregating 80 acres. The seed had been sown in trenches five or six feet apart, and the canal water was led through these trenches. It will suffice to give a brief account of the dimensions of the sissoo trees in two blocks of five and ten years old, respectively.

In the plot five years old (No. 17) the number of trees on a length of 25 feet was 9 (nearly 3 feet apart), the height was from 18 to 20 feet, and the average girth of the dominant trees was 7 inches. The grass was not entirely killed out; indeed, it is in places very heavy, although the trees have full and healthy foliage.

In the older plot (No. 1), the number of trees on a line of 25 feet was 7 (nearly 4 feet apart), height about 30 feet, and average girth of dominant trees 12 inches. In a portion of this plot alternate lines had been thinned out, leaving the lines of trees at a distance of 12 feet. The trees look healthy, the foliage is full, and the ground underneath is nearly covered. The remarkable point is that these trees, regarding the age of which there seems no doubt, should not have attained a much larger size, and the only explanation which occurred to us was that fire had on several occasions entered this plantation. The gardener declared that the plot had only been burnt once in the last nine years, *viz.*, in 1878. We found a number of dead trees, but no dry tops or branches, and no indication whatever which showed that the trees are not healthy and vigorous. There may be, and very probably is, a stratum of boulders in the sub-soil, which would explain the slow growth, but no explanation of this remarkably slow growth can be given until the younger plots have attained a greater age.

Hitherto all the younger plants have been regularly watered during the dry season, and water is available for any extension of these operations.

263. The not very rapid growth of sissoo suggests the trial of other trees, and as khair is indigenous here it will be well to try it. In two plots, Nos. 19 and 20, the trenches have been dug, and these should be sown with sissoo, khair, and mulberry. The different kinds should be sown in alternate lines, and, if seed can be got, one or two lines may be sown with mohwa. Bábul has failed, but it should be tried again, and some neem and *Ailanthus excelsa* should also be tried. The seed should be sown thick in the trenches, and it is hoped that three years' watering will suffice to establish the plants.

264. If this forest is to be maintained as such, its condition generally should be improved, and this can only be done by protecting it against fire. As a commencement, we recommend that one plot should be protected in the

northern and one in the southern part of the main block. At first it would be necessary to exclude cattle, but hereafter it will probably be possible to make special arrangements for pasture in the protected blocks, admitting certain villages only in each block, and making them responsible for the protection. It is not likely that the grass in the fire-protected blocks would find a ready market. As regards the future management of this area, we must await the effect which fire-protection will have on the spontaneous growth and the result of the sowings here recommended.

Kalushahid bamboo forest.

265. An area of 1,000 acres east of the Ráni Ráu has been protected against fire and cutting since 1879, *i. e.*, for nearly three years. The bamboo here (*Dendrocalamus strictus*) is chiefly found on the outer slope, and at the foot of the hills. The ground is exceedingly dry and stony, and the conditions for the experiment are not favourable: nevertheless the result has been most remarkable. The young shoots of 1880 are exceedingly numerous, tall, and of much greater girth than the old stems among which they have grown up. The experiment should be continued. There is of course the risk that some of the clumps may flower and die. On this poor soil and in this place, which is exposed to the hot winds, we cannot expect to produce bamboos as fine as those grown in the inner valleys of the Himalaya; but a considerable improvement has already taken place, and it should be ascertained to what extent the size and quality of the bamboos in this locality can be improved.

By way of experiment, a number of clumps have been partially cut over. This experiment should be continued in the following manner. In 10 clumps one-half of the stems should be cut; in 10 others all stems, with the exception of six in each clump, should be cut; and 10 others should be cut over entirely. The 30 clumps operated on should all be in the same locality, and as much as possible on level ground.

An experiment has also been made, with partial success, in planting up the flat ground below the forest with bamboos. We do not advocate the extension of the bamboo forest on a large scale on ground which can be used for cultivation, and which has actually been thus used. We are strongly of opinion that we should keep in view the necessity for establishing villages, under proper precautions, in those portions of our forests which were formerly under cultivation. It is most desirable, however, to plant bamboos as an experiment, and for this purpose an area has been fenced in, which seems to be suitable and which will be very instructive.

From what has here been stated it will be seen that the Central and Eastern Ranges are at present the most important as far as works of improvement are concerned.. Eventually, when such works can be undertaken in the Western Range, it may be desirable to sub-divide it, but for the present the existing organization should be maintained.

Revenue and Working.

266. The Saháranpur Forests, excluding Patri, have been divided into 39 blocks, both for administrative and revenue purposes. In the hills each block consists of the basin drained by a stream which rises in the main Siwálik Hills, and of these basins there are 12 in the Western, 9 in the Central, and 5 in the Eastern Range. The islands in the Ganges River form one block, and the forests outside the hills in the Central Range comprise 12 blocks. In the Patri Forest the blocks have not yet been finally formed.

This organization is to the point; it is in accordance with what was recommended in paragraph 93 of the Report of 1878, and it should be maintained. For administrative purposes it has been arranged to combine several adjoining blocks into one beat, and in accordance with this principle there are 9 beats in the Western, 9 beats in the Central, and 6 beats in the Eastern Range. The head-quarters of each beat during the working season are, as a rule, the revenue stations along the submontane road, and the total number of Forest Guards in charge of these beats is 51. These Forest Guards

have revenue work in addition to the protective charge of the forests, and hence it is found necessary to place several Guards at each of the more important revenue stations.

267. Regarding the system pursued in collecting revenue from these forests, reference may be invited to paragraphs 93 to 96 of the Report of 1878; the suggestions made in those paragraphs have for the most part been carried out, and it will suffice to state that in some blocks the revenue on dry fuel, bamboos, grass, and minor forest produce is leased to contractors, while in other blocks this revenue is collected departmentally. For the extraction of bamboos a regular system of rotation has been established, some blocks being closed while others are open.

Cutting of green timber.

268. Permission for the cutting of green timber for export on a large scale must always be obtained from the head-quarters office, and the plan followed has been to grant such permission in certain blocks only. The amount of green timber exported under this system has been as follows:—

Year.	Name of Block.	Description of timber.	Quantity, in cubic feet.	Revenue realized.
				Rs.
1878-79 ...	*Nil.*	*Nil.*	*Nil.*	*Nil.*
1879-80 ...	Morkota	Sál	1,952	641
	Ditto	Other kinds	46	9
	Lakarkot	Sál	277	104
	Andheri	Sál	1,083	406
	Ditto	Other kinds	141	35
	Dholkhand	Sál	1,219	457
	Ditto	Other kinds	318	73
	Khajnáwar	Sál	663	248
	Ditto	Other kinds	112	28
	Beri Bára	Ditto	58	14
	Gáj	Ditto	2,348	429
		Total ...	8,217	2,444
1880-81 ...	Khajnáwar	Sál	2,754	1,067
	Ditto	Other kinds	488	122
	Morkota	Sál	535	201
	Andheri	Sál	1,788	671
	Ditto	Other kinds	2,295	536
	Dholkhand	Sál	288	108
	Ditto	Other kinds	36	7
	Sukh	Sál	1,017	381
	Beri Bára	Other kinds	202	51
		Total ...	9,403	3,144
		Grand Total ...	17,620	5,588

269. Hitherto permits have been granted for certain quantities of timber to be exported from certain blocks within a certain time, and nothing was stipulated regarding the number of trees, or the minimum size of the trees to be felled, the only stipulation made being that no trees should be cut on narrow ridges and on steep hill sides. Under this system it is not impossible that a certain quantity of young trees may have been cut, and to guard against this in future it is intended that all trees to be cut shall be marked by responsible Forest Officers. As a preparatory measure, the quantity of mature timber standing in several hill blocks has been approximately determined in the Gáj, Betban, and Andheri blocks.

Passes for green timber required by the villagers for their domestic and agricultural requirements are under certain rules granted by the Officers in charge of the ranges and the Guards in charge of beats, the powers of Forest Guards and Range Officers being clearly defined.

Grazing dues.

270. The collection of the grazing dues for the cattle belonging to the villages adjoining the forests is at present made by the village revenue officials under the control of the Collector, and in order to enable the Guards in charge of beats to control the herds sent for grazing, a system of tickets has lately

been established. Cattle brought to the forest to graze from a distance are taken by the graziers to certain established stations, where they are counted, tickets being granted by the Forest Guard in charge of the beat.

Future cuttings.

271. The chief point to which we desire to draw attention in the working of the Saháranpur Forests relates to the cutting of green trees of sál and other kinds. It is most desirable to develop a steady demand for such wood, but, as already stated, no green trees, except on a small scale for the domestic and agricultural requirements of the adjoining villages, should be cut in any of the hill blocks protected against fire; and as regards the hill blocks not specially protected, every effort should be made to avoid felling in them to any large extent, and to induce purchasers to export the timber which they may require from the Dehra Dún Forests, which are much better stocked than those of the Saháranpur District.

Eventually, after fire-protection has been firmly established in the selected hill blocks, it will doubtless be possible, under competent supervision in detail, to cut old trees in localities where the forest is thick, without unduly increasing the risk of fires, and with the view of promoting a development of young growth. Subject to these general considerations, every effort should, as a matter of course, be made to develop a steady demand for timber from the Saháranpur Forests and to increase the revenue.

In order to determine the rate of growth of the sál tree outside the Siwáliks, it will be well to mark off a plot of about one acre in a position easily accessible, and periodically to measure all trees standing on it in the manner described in detail under this head in the Dehra Dún Division.

Rest-houses.

272. The following are the existing arrangements for accommodation of officers in the forests of this division. They have a share of a rest-house at Khára, on the Jumna, in the Western Range, a rest-house at Beri Bára in the Central Range, and a share of a rest-house at Maiapur in the Eastern Range. Two more rest-houses should be built, one in the centre of the Western Range at Kasumri Ráu, and another at Dholkhand in the Central Range.

Employment of Probationers and Apprentices.

273. Besides the charge of the three ranges in this division, the following may be noted as special work suitable for the employment of students at the Forest School:—plantation work in Patri and in Lakarkot, the periodical measurement of sál trees, and the examination of the mature timber standing in the hill blocks. Suitable subjects to be studied by the students will be the average height of sál poles in girth between 2 and 3 feet in the valleys and outside at different distances from the foot of the hills, and the circumstances which affect the growth in girth and in height of these trees. The study of the protected and unprotected bamboo forests, the examination of the mode of flowering and seeding, and the effect of cutting upon the development of the bamboos, may also be mentioned

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CHAPTER X.

DEHRA DÚN FORESTS.

Organization.

274. The forests of the Dehra Dún Division are at present divided into four ranges as follows:—

1*st*.—The *Western Range*, area 54,151 acres, comprising, besides the northern slopes of the Western Siwáliks, the detached blocks of Ambári, Chándpur, and Dholkot. Under existing arrangements all these forests are open to grazing, and are burnt as far as they are not self-protected.

2*nd*.—The *Central Range*, area 48,096 acres, comprising the closed and fire-protected forests on both sides of the Mohan road, from the Khajnaor Ráu to Jhabrawála, and including Nágsidh Hill and Lachiwála, which are open to grazing and are not protected against fire.

3*rd*.—The *Eastern Dún Range*, area 33,231 acres, comprising the closed and protected forest of Tháno, and the open forests of Málkot, Song, Tirsál, and Sainkot. Within it is the closed and protected Dáluwála plot, area 1,630 acres. To this range will be attached that portion of the leased Garhwál Forests which adjoins the Dehra Dún.

4*th*.—The *Eastern Siwálik Range*, area 42,301 acres, which extends from Jhabrawála to the Ganges, and is open to grazing and is not protected from fire.

Area protected against fire,

275. Of the total area of the Dehra Dún Forests, 27,664 acres are closed against grazing and protected from fire, while the remainder, 150,115 acres, is open and as a rule is burnt annually. In regard to fire-protection the Central Range is the most important. As explained in the Report of 1878, protection against fire was first commenced in the Bulawála Forests in 1872, and has been gradually extended over the entire Siwálik slope of this range. The protection against fire is secured by burning the grass and forest outside the lower edge of the closed area; and, towards the Siwálik Hills in the Bulawála Forests, by burning the forest outside a 200-foot line which was cleared about ten years ago. In the forests west of Bulawála the line towards the hills is a cleared road ten feet wide, not cut straight through the forest, but following the configuration of the ground so as to be useful as a bridle-path. The forest above the road towards the hills is burnt annually so far as is practicable. Regarding these exterior lines in the protected portions of the Central Range, we desire to submit the following suggestions.

Open grass lands on the edge how to be treated.

276. Along the lower edge there are large extents of grass lands within the closed area, which at present are a source of considerable danger, especially in the portion west of Assarori, where villages adjoin the forests. In some cases these grass lands will gradually get stocked with forest growth, if we succeed in protecting them continuously against fire, but in others they are not on ground suitable for the growth of sál. The risk from fire might be diminished, either by burning the grass entirely off them, or by isolating the plots by means of fire-traces between them and the forests. The circumstances of each case should be taken into consideration in choosing between these two methods, but it should always be borne in mind that a spark which falls upon grass land sets the whole ablaze, while a spark which falls into sál forests will in most cases be intercepted by the green foliage of the trees and will do no harm.

Boundary towards the hills.

277. As regards the inner lines towards the hills, we are disposed to advocate the adoption throughout of the plan followed west of Bulawála. The upper bridle road, which follows the old elephant track, may with great advantage be continued eastward as far as the Jhabrawála boundary line; and if the forest outside this path is burnt, there ought to be no risk on that side. As explained in the chapter on the Saháranpur Division, it is intended eventually to include the whole Siwálik Range at the head of the Rátmau basin within the fire-protected area down to the upper boundary of the Bulawála Forest: this plan, however, has not yet been carried out.

Interior lines.

278. The inner and outer fire-lines are joined by a number of more or less parallel lines, which, in accordance with the recommendations contained in paragraph 77 of the Report of 1878, have been laid so as to follow the configuration of the ground and to serve as export lines. These export roads are ten

feet wide, and are completely cleared, some of them being actually used by carts. A cart-road has also been made from Assarori to Bulawála, in order to facilitate the export of timber by the Mohan road. In the Bulawála Forest there was originally a system of straight lines at right angles to one another, one of which, the horizontal line known as Colvin's line, is still maintained; but experience has shewn the great difficulty of keeping these lines clear, as they do not follow the configuration of the ground and are never used for traffic.

The line known as Colvin's line will probably have to be maintained with a less width, but the straight transverse lines should be abandoned, and in their place a number of export roads following the configuration of the ground should be cleared.

Regarding the clearing of these 10-foot roads, which are of importance as interior fire-lines and to facilitate the export of timber, we desire to recommend that in the extraction of stumps the system now generally adopted in the Oudh Forests be followed, under which the chief roots are cut and the stem is used as a lever to extract the stump.

In the sál forests of Oudh, where the system of roads through the forests has been developed with greater success than in any other province, experience has shown fifteen feet to be the most convenient width of roads which are to serve as fire-lines and for the export of produce; and it has also been found that the maintenance of these roads is greatly facilitated by digging drains on the sides, and by forming a slightly raised road in the middle. On slopes and on broken hilly ground, like that of the Dehra Dún Forests, these conclusions may not in all cases hold good; but they are mentioned here for the consideration of the local officers, and for adoption wherever this may be feasible. Two traces are cut parallel with the existing export roads in the Central Range, and the grass between the traces and the road is cut, the grass being burnt in the hot season. If 15-foot roads are generally adopted and kept clear, the dry leaves being swept up during the most dangerous part of the hot season, it will probably not be necessary to maintain the traces, nor will it be necessary to burn the grass and brushwood on both sides of the roads. It will be found in course of time that the forest on the sides of these roads will grow up densely and that the road will be overshaded by it, and this is one of the chief advantages of roads of this description.

Thinnings.

279. In paragraph 79 of the Report of 1878 the thinnings made from 1876 to 1878 have been described. The late examination of this area, 1,920 acres, has confirmed the apprehensions there expressed: the ground is still covered with a dense mass of grass, which has only in a very few localities been replaced by the coppice-shoots of the pre-existing growth. These coppice-shoots have suffered severely from frost, and in many cases from the attack of a black fungus. Very few seedlings were found in the grass, although fortunately it has been possible to protect this part of the forest against fire; and the ground is still covered with logs, tops, and branches, so that should, by any misfortune, fire enter the forest the damage would be incalculable.

At first sight these thinned compartments have a regular and neat appearance, but on closer examination they are found to be exceedingly unpromising and unsatisfactory.

280. In paragraph 80 of the Report of 1878 suggestions were submitted regarding the cutting out of mis-shapen trees: the thinnings then recommended have been carried out over an area of 640 acres; the sál trees selected to be thinned out were girdled, but this operation has not been successful, as explained in paragraph 40 of the Annual Report for 1879-80. It seems clear that sál trees killed by girdling are much more exposed to injury by the attacks of insects, than trees which die and dry up naturally. In future it will be necessary to abandon the plan of girdling the sál trees before felling. The area from which the trees thinned out under this plan have been removed shows a much heavier growth of grass than is desirable, and the question was raised, while we were engaged in examining these compartments, whether the trees marked for thinning out in 1880, but not cut, should be felled. We have come to the

conclusion that it will be best to complete the experiment as originally contemplated: there will then be 1,280 acres thinned on the new plan, the progress of which may be compared with the 1,920 acres thinned out in 1876-78.

281. After this area has been completed it will not, however, be desirable to continue these operations in the Bulawála Forests, where the soil is poor, sandy, and full of boulders; and we recommend that, instead thereof, thinnings be undertaken on both sides of Assarori, where the soil is more binding, richer, and much moister. In these localities the leading principles should be to cut out mis-shapen trees of all kinds where the forest is otherwise sufficiently thick, the more valuable kinds mentioned in paragraph 80 of the Report of 1878 being spared. In that part of the forest a considerable number of well shaped sál trees of marketable size are found, and these may be cut whenever they stand over sufficient thickets of advance growth.* It will be understood that these operations must proceed in regular order by compartments; the area to be taken in hand annually may be settled hereafter, with due consideration of the demand for timber and the quantity of timber obtained from the areas treated in this manner.

Regarding the experimental cultivation of sál, the same course should be pursued here as has been suggested for the protected area of the Saháranpur Division.

Treatment of the open forests.

282. The improvement in the condition of the forests not specially protected from fire is, as far as we had an opportunity of seeing it, very considerable wherever the soil is favourable. We have agreed that, besides the areas already mentioned, no extension of the area regularly protected from fire shall be attempted for the present; but we desire to submit that it is a good plan to make roads throughout the forests, whether specially protected or not, in order to prepare the way for regular fire-protection hereafter, and also to stimulate the export of dry wood and of such green timber as it may be possible to cut.

A good commencement in this respect has already been made by the construction of a fair-weather cart-road through the Lachiwála Forest, from Bulawála to the Hardwár-Dehra road. Similar roads, we submit, might be made to connect the Eastern Siwálik Forests with the Dehra-Hardwár road, and the forests on both sides of the Timli Pass with the Saháranpur-Chakráta road. These roads should be constructed on the same principles as the export lines in the Central Range, and eventually a system of such roads may with great advantage be laid thrcugh the whole of the open forests of the division.

283. The thinnings proposed to be made in the Central Range, on both sides of Assarori, will furnish a considerable annual supply of timber to be exported by the Mohan road, but it is desirable to stimulate the export of timber by other lines also. Of these the most important are the Jumna River, the Timli Pass road, the Khánsrao Pass, and the Hardwár road. The area of the sál forests in this division is so large, and the quantity of wood which is annually added to the growing stock is so considerable, that we shall be justified in recommending regular annual cuttings on a moderate scale in the vicinity of each of these main export lines.

Export of timber from private forests.

284. But before making more definite suggestions in this direction, it will be well briefly to advert to the export of wood from private forests in the Dehra Dún. This export is very considerable, and it is not sál only but chír and other woods also which are exported on a large scale. We visited two private forests on the west side of the Government forest at Ambári: one estimated to cover about 5,000 acres, leased to a native merchant at Saháranpur, who is said to have paid the sum of Rs. 17,000 for the right of cutting timber during a period of seven years; and a second forest estimated to contain 2,500 acres, leased under the same conditions, and for an equal period, on the payment of a sum of Rs. 11,000. The timber from these forests is exported in the shape of karris and other scantlings, which are partly floated

* We have agreed to use the term "advance growth" for what Foresters in Germany call *Vorwüchse*, that is, young growth found in old forest before regeneration cuttings have commenced.

down the Jumna and partly carted out by the Timli Pass road. The remaining wood is converted into charcoal, which we were informed is sent to Roorkee. There seems good reason to believe that during the last five years the export of timber from the private forests of the Dún has increased considerably; and there is no ground to apprehend that timber felled in the neighbourhood of the lines of export already mentioned will not find a ready sale. If the localities where the cuttings here proposed to be made are judiciously selected, the demand for timber in the Saháranpur District may perhaps to some extent be supplied by the cuttings suggested in the Dehra Dún Forests.

Regarding the localities where these cuttings should be made, it will suffice to suggest that a commencement should now be made to select those areas which will be chiefly valuable as grazing grounds for the adjoining villages, and to separate them from the areas which it is intended permanently to maintain as forest. Obviously it is of much greater importance to maintain a complete forest growth on those lands which are to be devoted to the production of timber, than on those which are to be used as grazing grounds. Wherever such a separation can be made, it will be well to spare the forest and to make cuttings in preference on the lands in the vicinity of villages.

285. A better plan would be to demarcate areas for protection against fire and grazing in the vicinity of the great lines of export mentioned, and only to cut within them. If this were feasible, and if the protection from fire could be made perfectly certain, it would be possible to cut the quantity required in areas protected from fire. Should this plan be found practicable, it should as a matter of course be adopted, but until these new areas have been placed under protection against fire it will be unavoidable to cut a certain quantity of timber outside the protected areas. Under these circumstances, the question arises how these cuttings should be arranged with the least possible injury to the permanent interest of the forests; and this can, in our opinion, only be solved by making the cuttings in those areas which it is not intended to maintain permanently as forests.

Periodical measurement of trees.

286. The fenced sample plots in the Bulawála Forest, in which the periodical measurement of sál trees has hitherto been made, are not very suitable for this purpose, and it will be necessary to select plots in other places. The object of these periodical measurements is two-fold, *viz.*, to determine the rate of growth of individual trees, and to ascertain the annual timber production per acre. In a preliminary manner, we have selected suitable localities in the Phandawála and Lachiwála blocks; and in each of these two localities plots of about one acre in extent should be marked off by ditches. On these plots the forest should be as well stocked as possible, and the first operation will be to thin out all suppressed trees and all shrubs and irregularly shaped trees which are not likely to form part of the final crop.

All the remaining trees should be measured twice a year—once as soon after the rains as possible, and once during the hot season before the monsoon commences. The most convenient times for these measurements would probably be the beginning of November and June. It is essential that each tree should be always measured at the same point, and the experience gained in Oudh shows that a ring of zinc paint lasts sufficiently well to be used to mark the point where the measurement should be made. It is also essential that the measurement should be made at a point where the stem is round and regularly shaped and if possible perpendicular; but it is not necessary that all trees should be measured at the same height above the ground. It will be well to set aside one measuring tape for this work only, and to divide it into tenths of an inch. It will be understood that all trees standing on the selected plots, not the sál trees only, will be measured, and that the plots should, as a matter of course, be protected from fire.

Instructive work for Probationers and Apprentices.

287. Besides the charge of the ranges and sub-divisions of ranges, the plantations, and the periodical measurement of trees, the most instructive work in the Dehra Dún Division on which the students of the Forest School

may be employed will be the selection of the trees to be thinned out in the blocks protected from fire and the arrangement of the cuttings, if any should become necessary in the open forests. It will be possible in this division to produce a considerable amount of revenue by such thinnings and cuttings in different places, without any injury whatsoever to the forests, provided the trees cut are selected with due care in detail and with full consideration of all circumstances. This is a work which is both instructive and useful, and no pains should be spared to make a suitable selection of every tree to be cut; and the students employed on such work should be required to record a detailed account of their proceedings in this respect.

288. The extensive sissoo and khair forests along the Song River and elsewhere in this division will afford much interesting work. Very little is as yet known regarding the circumstances under which the natural reproduction of sissoo and khair takes place, and this subject should be systematically studied in those portions of the low-lying forests which can be protected against fire. An interesting branch of forest industry in this division merits further study than has yet been given to it; this is the extraction of gum from the semla tree (*Bauhinia retusa*). The tree is not uncommon, and the export of the gum is considerable, so that it is well worth while to make experiments regarding the yield of gum at different seasons and under different modes of treatment. The avenues of tún and other trees along the canals in the Dún are also a most interesting subject of study. The age of most of these avenues is well known, and it would be a task of considerable interest to determine the rate of growth and timber production of the trees planted along these canals This is a work which should be taken in hand at an early date.

CHAPTER XI.

FORESTS IN JAUNSAR.

Organization.

289. The forests of the Jaunsár Division have been divided into three ranges, each range has been divided into forests, and each forest into a number of blocks.

The ranges are as follows:—

1*st*.—The *Southern Range*, area 8,314 acres, comprising a number of scattered plots, *viz*., the Kálsi, Bairát, and Amláwa Forests, two strips along the Tons and Jumna, and three deodar forests in the Jumna Valley in pargana Rawai of Tiri-Garhwál.

2*nd*.—The *Deoban Range*, area 35,363 acres, comprising the Lokandi, Deoban, Ekra, Karámba, and Konain Forests.

3*rd*.—The *Báwar Range*, area 33,063 acres, comprising the forests in the valleys of the Riknár, Dháragádh, and Dharmigádh, and those near the Tons in the vicinity of Bástil.

290. The Southern Range comprises only second class reserved and leased forests, none of which are protected against cattle, but the greater portion of which are protected against fire.

The Deoban Range comprises the first class reserves of Bodyár, Kanásar, and Konain, aggregating 2,200 acres, while the aggregate area of the second class reserves is 33,200 acres. Of the second class reserves in the Deoban Range, however, a portion, aggregating 5,423 acres, is closed against fire and grazing.

The Báwar Range includes the first class reserves of Tutwa, Lakhau, Katián, and Koti, aggregating 2,968 acres; while the second class reserves comprise an area of 30,095 acres, of which about 5,123 are protected against grazing and fires, and 3,378 acres against fire only.

In addition to these, the division includes the forest garden at Chakráta, as well as two blocks, aggregating 500 acres, which have been demarcated

within cantonment boundaries, and have been handed over to the charge of the Forest Department.

291. The permanent establishment entertained for the care of these forests consists of three Foresters and eighteen Forest Guards. It will be noticed that there are no Rangers, and an insufficient number of Foresters. The idea is that Probationers and Apprentices shall be employed to have charge from time to time of the more important ranges or forests in which instructive work is going on.

292. It may be as well here to mention that during the next five years such works will chiefly be carried on in the following forests :—

The *Lokandi Forest*, where the planting up of the Bodyár first class reserve must be completed and considerable fellings made.

The *Deoban Forest*, where the planting up of Mátkángra, with the land in cantonments, the planting up of the blank slopes in Mohna, and the proposed cuttings in Mohna and Thona, will require supervision in detail.

The *Ekra Forest*, where the cuttings in Hajáwa must be attended to.

The *Dháragádh Forest*, where the protection and working of the rich deodar forests of Maura and Lakhau, and the arrangements for the carriage of timber to the Tons, will require the services of a skilled officer.

Thus there will be instructive and useful work for the students at the Forest School while under practical training. For a considerable number of students the division will furnish work for eight months in the year, from the 15th April to the 15th December. During the four winter months the work on which they might be employed is usually limited to planting in cantonments, and to such works as clearing out of streams, building roads and slides at low levels in the Dháragádh or elsewhere.

During these four winter months, therefore, the majority of the Probationers and Apprentices must be employed in other divisions.

Maps.

293. For the forests of the Jaunsár Division, the following maps are available :—

1*st*.—Maps of the Deoban Working Circle, including Bodyár and Hajáwa, on the scale of 4 inches to the mile, surveyed and published by the Forest Survey.

2*nd*.—Maps of the remaining forests on the scale of 2 inches to the mile, surveyed by the Forest Survey, but published by the Great Trigonometrical Survey.

These maps are excellent and sufficient for all present purposes. In the case of the Mohna block only it is proposed to have a larger scale map, with some additional topographical details; and the same may perhaps eventually be necessary for the blocks placed in charge of the Forest Department within cantonments.

It would be a great advantage, in the more important forests, to determine the elevation of a larger number of points than those entered in the maps; and, if at any time the services of a competent officer should be available for such work, it would be well to enter on any large scale maps that may hereafter be required contour lines at vertical distances of, say, 500 feet.

Fuel supply to Chakrata.

294. The circumstances under which Chakráta is supplied with fuel from the forests of the Deoban Range have not materially changed since the Report of 1878 was written, and it will therefore suffice in this respect to refer to paragraphs 33 to 35 of that Report.

The annual consumption of firewood was at that time assumed to be 200,000 cubic feet of solid wood; this, however, has been far in excess of the actual annual requirements during the last three years, because the station was only occupied during a part of the time.

The actual consumption of the last eleven years, expressed in solid cubic feet, has been as follows :—

Year.	Oak.	Fir.	Total.
1870-71	No record distinguishing between oak and fir during these years.		177,620
1871-72			147,860
1872-73			213,350
1873-74			129,390
1874-75			151,964
1875-76			No record available for this year.
1876-77			235,068
1877-78	40,921	45,457	86,378
1878-79	30,236	73,604	103,840
1879-80	39,626	48,073	87,699
1880-81	23,305	67,612	90,917
	Average for ten years = 142,408 solid cubic feet.		

The period to which these figures relate was, however, quite exceptional, and for the future it will be safest to provide for an annual consumption of 200,000 cubic feet of solid wood, although there may be years when the whole of this quantity may not be required.

Area available.

295. In order to furnish this quantity, we have under our control 5,423 acres within moderate distance from Chakráta, which are at present protected against grazing and fire. The details are entered on the margin. In addition to this area, we have 12,000 acres, also within moderate distance, protected against fire, but not against grazing; and 5,800 acres more, mostly at a lower level in the valleys, which are grazed over and burnt annually. The most valuable portion of this aggregate area of 23,200 acres is the 5,400 acres protected against grazing and fires.

	Acres.
Bodyár	1,463
Kanásar	173
Konain	374
Thona	466
Kanjatra	665
Matkángra	405
Mohna	865
Kophti	217
Hajáwa	400
Bájamára	325
Leguna	52
Siári	18
Total ...	5,423

It will, however, be remembered that of this area only a small portion (2,173 acres) is first class reserved forest, and that only 2,010 acres are actually closed and under strict protection permanently. As regards the rest, it may be necessary to effect exchanges, opening blocks hitherto closed and adding others to the closed area. In this respect it will be well here to state that, in making such exchanges, the aim should be as much as possible to open to pasture lands situated at high elevations, where the growth is slow and the reproduction more uncertain and difficult than at lower levels. Moreover, there is more demand for high level grazing on the part of the surrounding villages than for pasture at lower levels. On the other hand, the consideration that it is cheaper to carry wood down-hill than up-hill will receive due weight whenever occasion should arise for modifying present arrangements regarding grazing.

Of the 5,400 acres of forest completely protected, it may be said that 3,000 acres are at present stocked with forest, while 2,400 acres are blank; and of the stocked area again about one-half, or 1,500 acres, is situated above 8,000 feet, where reproduction is more uncertain, and where fellings must be made more cautiously than in areas situated at a lower level.

296. Taking all these circumstances into consideration, we are justified in saying that the area (5,400 acres) of completely protected forest land will not be equal to furnish in their present condition an annual yield of 200,000 cubic feet of solid wood permanently. We have, therefore, come to the conclusion that, until the area protected against fire and grazing has been completely planted up and brought into a perfect and uniform state of protection, it will be unavoidable to draw a considerable portion of the annual supply from the 12,000 acres which are protected against fire, although they are not protected against grazing. Of this area also, a portion only, probably not more than

one-third, is stocked; so that, for the present, the forest which is to yield the wood for Chakráta consists of 3,000 acres stocked in the area completely protected, and 4,000 acres in the area open to grazing.

297. The proposals regarding cutting submitted in the present Report will be confined to the next five years, and for this period, and indeed for a much longer period, it will not be difficult to satisfy the annual demand by making in the completely protected area the cuttings which are necessary for the improvement of the forest. The question, therefore, of cutting in the area open to grazing does not press at present, and it will suffice to say that such cuttings are only admissible in localities where young growth already exists on the ground.

We are of opinion that during the next five years, that is to say, from 1881-82 to 1885-86, the cuttings which it is desirable to make for sylvicultural reasons in the Mohna, Hajáwa, Thona, and Bodyár blocks, together with the dry wood which will be collected from the whole of the area, will suffice to furnish the requirements of Chakráta.

It should here be mentioned that this relates to wood fuel only, and that the charcoal required for the station is mostly supplied from private forests near Ambári and from the Government forests near Kálsi. All this charcoal—nearly the whole consumption at Chakráta—is brought up by carts from low-level forests.

Cuttings in Mohna block.

298. The Mohna block, as explained in paragraph 40 of the Report of 1878, now includes the upper part of the Kanjátra and Jádi blocks.

The total area of the Mohna block is 1,315 acres. Of this area, 865 acres are protected against grazing and fire; the stocked area in the protected portion is 600 acres, of which 500 acres are above 8,000 feet and 100 acres below 8,000 feet in elevation.

We have agreed to divide the protected portion of this block into fourteen compartments, as follows :—

Top of Deoban Hill	...	(1) Gona Kai. (2) Chakráta View. (3) Snow View, west. (4) Ditto, east.
Kua basin	...	(5) Kua head. (6) Kua, south. (7) Do., north.
Rangai basin	...	(8) Rangai, south. (9) Do., north.
Katbau basin	...	(10) Katbau, south. (11) Do., north.
Agar basin	...	(12) Deothát. (13) Agar, south. (14) Do., north.

Compartment No. 1, Gona Kai, comprises that portion of the block which is nearest Chakráta; it is a well stocked forest of bán and moru, at an elevation of 7,500 feet, with a north-easterly aspect.

The boundaries of these compartments are well defined by roads and natural features, and in a few instances only will it be necessary to make additional paths as boundary lines. Pillars, with compartment numbers, should be placed wherever a path crosses a compartment boundary and at other suitable places. In 1876 Mr. Dansey divided the Mohna block into 39 compartments, partly according to the configuration of the ground, partly according to the character of the forest. The arrangement now proposed seems to us more simple and useful. To prevent confusion it will be necessary to remove the compartment pillars erected by Mr. Dansey.

299. In order to facilitate a precise record of the progress of the cuttings and cultural operations, it will be necessary to prepare a map of the Mohna block on a larger scale; and we recommend that, as an experiment, a map be prepared on a scale of 16 inches to the mile, containing all details of the

existing map, except hill shading, all paths and compartment boundaries being shown. Eventually, whenever practicable, 500 feet contour lines should be added, and an area statement of compartments should be prepared.

Former cuttings, Mohna block.

300. The portion of Mohna to which these remarks relate has been continuously protected since 1871, and the effect of this protection is clearly visible in the very heavy grass with which the blanks are stocked, as well as in the deep layers of decaying leaves and needles which cover the surface of the ground. The beneficial effect of ten years' protection is also seen in a large number of seedlings which have come up during this period near the edge of the forest, and in the case of the two oaks (karshu and moru) also in the forest. As regards the pines, the seedlings which have come up since protection commenced are not very numerous, except on the edge of blanks. It should, however, be mentioned that numerous seedlings of the blue pine, of a less age than ten years, are found scattered on nearly all blank slopes.

301. The cuttings which have been made since protection commenced have been as follows. Between 1875 and 1877 cuttings were made over 311 acres, chiefly in the Rangai, Katbau, and Agar basins. These cuttings have yielded 252,000 cubic feet stacked wood of oak and 282,000 cubic feet stacked wood of fir—total 534,000 cubic feet of stacked, or 356,000 cubic feet of solid, wood, which is at the rate of 1,145 cubic feet of solid wood per acre. These cuttings were made partly by Mr. Bagshawe, partly by Mr. Dansey, and the object was to afford sufficient light for the young growth to come up, and at the same time to leave a sufficient number of trees for shelter and to shed seed.

The selection of the trees cut has evidently been made with great care; the forest thus treated presents a very regular appearance, and at first sight the operation would seem to leave nothing to be desired.

Natural reproduction since cuttings were made.

302. As regards natural reproduction, however, the result has by no means been satisfactory. Oak seedlings of less than five years' growth are numerous in places, but the young growth of spruce and silver fir, which form the great mass of the forest in these cuttings, is almost entirely limited to the advance growth, which was on the ground before the cuttings were made. This advance growth was fortunately abundant in places, and it has greatly profited by the light given it. There are exceptions, but as a rule these exceptions are only found along paths, or in other places where the firm surface soil has been exposed. On the deep layer of decaying rubbish, leaves, needles, and herbs, scarcely any young seedlings of the spruce and silver fir were found.

It is true that at this elevation the spruce and silver fir do not seed regularly, and since these cuttings were made, there has been only one good seed year (in 1878). As a rule, abundant seed does not form on these trees oftener than once in three or four years. The two oaks, karshu in particular, seed more regularly than the pines.

Suggestions for the future.

303. The conclusion which a careful examination of this area has forced upon us is that the acorns of both moru and karshu germinate readily, and produce young plants on the loose and soft layer of needles, leaves, and rubbish; while the lighter seeds of the pines, although they may germinate, dry up again before their roots reach the solid ground. Clearly, therefore, some other arrangement of cuttings must be made in order to ensure the natural reproduction of these forests; but whatever arrangement may be devised, it will be necessary to wound the soil and thus to expose a firm surface to the roots.

Fellings of a similar character were made in 1880 in the basin of the Kua stream, where 57 fir and 77 oak trees were cut. These trees were cut chiefly over advance growth. In the same year cuttings were made on a small scale in the karshu forest of the Snow View compartment, in order to give light for the seedlings of karshu to spring up.

Coppicing of Karshu.

304. The two plots of karshu which were cut over in April 1874, in order to test the coppicing power of that tree, adverted to in paragraphs 22 and 23 of the Report of 1875 and in paragraph 53 of the Report of 1878, should here be mentioned. The result of this operation has so far been unfavourable, that many stumps, particularly of the older trees, have not thrown out any coppice-shoots at all. But it should be remembered that the manner in which this cutting was made did not give the trees a good chance; the stems were cut at different heights above the ground, and in no case was the cutting so made as to promote the growth of the coppice-shoots. On our present visit the average length of ten shoots of last season (1880) was found to be 8½ inches, which, considering all circumstances and the high elevation (9,100 feet), is not unfavourable.

Former cultural operations.

305. The most important and successful attempt at planting in the Mohna block was made during the rains of 1873 by Mr. Whittall; it is referred to in paragraph 23 of the Report of 1875. The result of this operation is now visible over a large extent of blank grassy slopes in the Rangai, Katbau, and Agar basins, where the ground is fairly stocked with young plants of karshu, the height of which varies from two to three feet. Wherever neighbouring trees afforded a little shelter, the plants have grown more vigorously and have attained a greater height. About the same time a large number of spruce plants were raised in nurseries and planted out in 1876, and of these also a considerable number survive, which have attained about the same size as the karshu.

The soil on the blank grassy slopes which were thus operated upon is favourable, and the matting of grass is by no means as thick as in Bodyár, but the appearance of the karshu and spruce plants mentioned shews at a glance that some shelter is required in order to induce them to grow up more vigorously.

Blue pine self-sown on blank slopes.

306. Over the whole of these slopes we noticed a large number of vigorous plants of the blue pine, many of which, although of younger age, had attained a height of from 6 to 8 feet, with the shoots of 1880 up to 24 inches in length. It is well known that the blue pine thrives while exposed to the full power of the sun on blank slopes, and its cultivation on a large scale in this locality, with the view of affording shelter to the oak and spruce, is clearly indicated.

It is a remarkable fact that this tree is not common anywhere in the Deoban Range, except on the north-east face of Moila Hill, on the northern slope below the Kophti Peak, and on the northern slope of the Konain first class forest; and it is probable that all the blue pine which we find in this part of Jaunsár belong, not to the original, but, so to say, to a secondary forest growth.

307. As far as we know, the blue pine in the Mohna block does not thrive after it has passed a certain age. A stem in Katbau south, on a moderate slope, north-east aspect, at an elevation of 8,400 feet, had in forty years attained a diameter of 15 inches only.

It is quite possible that the blue pine which we propose to plant in this block may not grow to any considerable size, or attain any great age; but provided its growth is (as we have noticed it to be) rapid while young, the tree will serve the object of affording shelter to the young spruce and oak.

Other trees planted.

308. A large nursery, chiefly of horse-chestnut, maple (*Acer cæsium*), and bird-cherry (*Prunus Padus*), was made about 1873 in a hollow near the bungalow, and the plants raised were planted out all over the blank slopes in the lower part of this block. Of these a large number of horse-chestnuts remain, but they have grown very slowly, which is not surprising, considering

that they were not planted in moist places, which are the natural habitat of this tree, but on dry sunny slopes, where the tree cannot be expected to thrive. We were unable to find any plants of the bird-cherry or maple.

Another nursery was formed about the same time at Deothát, and, in accordance with a recommendation made in paragraph 63 of the Report of 1878, a forest garden was established at Deothát, at an elevation of about 8,400 feet, where 8,000 deodar plants and a small number of the blue pine and the spruce are at present available for planting out.

Proposals for future treatment.

309. As regards future treatment, it will be convenient to discuss separately the area stocked and the blank slopes. As regards the cuttings to be made within the next five years, the general principle may be laid down that old trees must be cut only where sufficient advance growth already exists on the ground, or where it is intended to make experimental cuttings with a definite object. To begin with the former class of cuttings, a considerable quantity of timber may be obtained by cutting trees over advance growth in those compartments where no cuttings have as yet been undertaken, particularly in Snow View west and in the Kua basin. Here and there it will also be necessary to cut out trees standing over advance growth, where previous cuttings have already been made. But, as a rule, we have decided that no cuttings should be made in those localities where the first cuttings were made in 1876-77, until more experience has been gained regarding the natural reproduction after cutting.

Cutting proposed in Snow View.

310. As regards experimental fellings, it is proposed to make a heavy cutting in the karshu forest of Snow View east. As explained at page 29 of the Report of 1875, the ground under the old karshu forest is covered with a large number of seedlings, most of which for want of light come to nothing. We have decided, as an experiment, to recommend a heavy cutting in a portion of this compartment, leaving on the ground only groups and belts of vigorous and comparatively young trees. In making these clearances, care should be taken not to clear entire stretches from the top to the bottom, and thus to prevent the formation of gullies, in which the snow accumulates and, sliding downwards, destroys all young growth. The clearances should be made in patches of a considerable size, but these patches should be interrupted by belts of standing trees and should nowhere be continuous. This forest contains a small proportion of old spruce, which, if healthy and vigorous, should be spared.

We have considered whether this cutting should be made in spring or in autumn. The flowers of this oak appear, together with the young leaves (at this elevation), in June; but the acorns require a little more than a year to ripen, and are so small in early spring that it cannot readily be determined whether there will be a full seed year or not. Under these circumstances, we have decided to recommend that the cutting here proposed should be made in the autumn succeeding an abundant fall of seed. The wood should all be cut up and stacked on the road side before winter, so as to cause the least possible injury to the young plants. The greatest enemy of the young plants of the karshu will doubtless be the heavy growth of *Strobilanthes*,* balsams, and other herbs, which will cover the ground after cutting, for even under the dense shade of the old forest there is a thicket, chiefly of *Strobilanthes*, more than two feet high.

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* Two species of *Strobilanthes*, with blue flowers, are common in the forests of the Deoban Range, between 8,000 and 9,300 feet. *Strobilanthes Wallichii*, N. ab E., is a remarkably gregarious plant, covering extensive areas to the exclusion of other plants under the deep shade of the karshu forest of Snow View. In Hajáwa and elsewhere it is found under spruce and silver fir. It is an undershrub, the stems sub-divided into numberless branches, which are jointed and break off readily at the nodes. In spring the tufts of this plant are two to three feet high, and present a mass of short stiff twigs, half woody, with small cordate, nearly glabrous leaves. At the commencement of the rains these tufts shoot forth the long herbaceous branches bearing lax panicles of blue flowers.

The other species, *Strobilanthes attenuatus*, Jacq., is found on more sunny slopes, and is common in the warmer part of the Mohna block, while it is almost unknown on the cooler slopes of Hajáwa. The plant is perennial, but the stems and branches are herbaceous; the leaves are larger, long-acuminate, and very hairy, with glandular hairs.

Cutting proposed in Katbau.

311. In another part of the block, at a lower elevation, in the compartment which we have designated South Katbau, it is proposed to make a heavy cutting on a limited area similar to that suggested for the karshu forest of Snow View. The forest here consists of moru and spruce, with a little silver fir in moist ravines. Where the cuttings of 1875 to 1877 had been made, the ground is covered with the cones of 1879 and 1880, which would lead us to conclude that a large quantity of seed must have fallen; but, with the exception of the edges of roads, seedlings of the spruce are exceedingly scanty, though there are numerous seedlings of moru. The cutting should be similar to that proposed for Snow View, groups and belts of vigorous trees of all species being left standing.

Wounding of the soil.

312. So far we have treated of the cuttings proposed to be made in this block. Over the whole of the stocked area, wherever cuttings have been made previously, or are now proposed to be made, and elsewhere in suitable places, we consider it necessary that the firm soil should as much as possible be exposed, so as to facilitate the growth of seedlings. It will now be well to establish a regular system of wounding the soil for this purpose in patches and interrupted lines. The work must be done rapidly, and it will probably be as well to assign a limited area to each labourer. A light and suitable instrument will eventually have to be devised for this operation, which will doubtless become a matter of great importance hereafter. In order to ensure full success, the surface soil should be wounded shortly before the seed of the two coniferous trees falls, and obviously the operation must only be undertaken in good-seed years.

Treatment of blank slopes.

313. It has already been explained that, in order to afford shelter to the numerous plants of karshu and spruce on these slopes, blue pine should be planted largely. For this purpose it will be necessary to extend the Deothát nursery, and to raise plants of this tree on a large scale. It would not, however, be right to confine these operations to the blue pine; for although this tree shows a more rapid growth on open and dry slopes, yet in suitable localities, where there is moisture and partial shelter, the progress made by young plants of the spruce and silver fir is almost equally rapid. We therefore recommend that the Deothát nursery should be employed to raise strong plants of all the coniferous trees which constitute the forest in the Mohna block, *viz.*, blue pine, deodar, spruce, and silver fir.

314. As regards the localities where the different kinds should be sown or planted out, it will suffice to say that the most suitable place for deodar is above the lower boundary road, whence carriage to Chakráta will be easy; that spruce and silver fir should be planted out wherever there is moisture and shelter; and that all dry slopes, as far as they will not be planted with deodar, should be chiefly sown and planted with blue pine. The general practice should be the same for all these four kinds, *viz.*, to sow in lines of patches, the distance between the lines being, according to circumstances, fifteen feet or more. As regards the preparation of the patches, we recommend that they should not be dug up too deep, and that the soil should not be made too loose; they should be longer in the direction of the lines, and a large quantity of seed should be sown in each patch. Every good seed year should be utilized in order to raise a large number of plants in nurseries, which alone will make it possible to continue these cultural operations without interruption. Where trees of different kinds are sown on the same slope they should be sown in alternate lines. As a rule, all patches where the seed has failed should, in the year following, be planted up from the nursery. The whole of the arrangements should be so made as to guard against failures on a large scale. It would be well to let these operations progress on a definite plan, commencing at the northern end of the Mohna block and proceeding in regular order southwards.

Hajawa Forest.

315. Reference may be made to the description of the Hajáwa block given in paragraph 30 of the Report of 1875. 400 acres of that portion which is situated between Hajáwa ridge and the stream of that name have been protected against grazing since the spring of 1880. Of this area it may be estimated that 350 acres are stocked, 230 acres being above and 120 acres below the level of 8,000 feet. Inspection paths and fuel-carrying roads have been made; the forest has been divided into four compartments; and, in the place of the former slide, a fuel-carrying road has been made connecting it with the lower Mohna road above Kandál. Fellings were commenced in May 1880, and altogether 500 trees have been cut. The trees have been selected, partly where advance growth was on the ground (chiefly in compartment No. 1); but cuttings have also been made in other places where it seemed desirable to give light in order to favour the development of young growth. These cuttings were made chiefly in compartments Nos. 2 and 3.

316. For sylvicultural reasons, cuttings in this block do not press, but as they have been commenced, and as roads have been made for the purpose, it seems for practical reasons expedient to continue them simultaneously with the cuttings proposed in Mohna, the object being to develop the system of working of this block, which is rather distant from Chakráta, and the working of which can only be made cheaper by steadily continuing it on a moderate scale.

These circumstances make it desirable to continue the cuttings for the present, and we suggest that all mature trees standing over advance growth be cut, and that the other cuttings be confined to compartment No. 3. The system will be the same as that recommended for Mohna, that is, the cuttings are to be made in interrupted belts, groups and belts of younger trees being left standing.

The soil in the Hajáwa Forest is probably in a somewhat more favourable condition for the development of young growth than that in Mohna, the forest consisting chiefly of spruce and silver fir, and the ground being more firm through pasture having been continued until quite lately.

It is, however, not impossible that, in spite of the greatest care in the arrangement of these cuttings, natural reproduction may fail, and that it may be necessary to assist it by planting and sowing.

Thona.

317. After the cuttings here sketched have been completed in the Mohna and Hajáwa blocks, the Thona block should be taken in hand. The total area of the block is 466 acres, the whole of which has been protected against fire and grazing since the spring of 1877. Of this area 300 acres are estimated to be stocked, namely, 120 above and 180 below 8,000 feet. In the higher portion of this block, along the high level road from Deoban to Bodyár, no young growth is as yet visible, and the protection against grazing has not as yet had any effect; but on lower levels reproduction is exceedingly satisfactory along the edge of the forest and on blank slopes, some of which are well stocked with young plants of blue pine, spruce, and here and there of deodar. At these levels in the forest there is a considerable amount of advance growth and extensive thickets of ringal; but the cover is too dense to admit of any seedlings springing up. In the lower part of this block heavy cuttings may be made wherever there is advance growth on the ground. In order to ensure a proper system in the cuttings, it will be necessary to establish compartments before operations commence.

Bodyar.

318. It is impossible to foretell the quantity of wood which the cuttings here recommended for Mohna, Hajáwa, and Thona will yield, but it does not seem impossible that they will, together with the dry wood collected in the forests, furnish the requirements of Chakráta during the next five years. Should this expectation not be fulfilled, it will be necessary to cut in the Bodyár block in the manner suggested in paragraph 37 of the Report of 1878. The cuttings which will be made in this block will yield a certain quantity of deodar, which may either be used at Chakráta or exported *vid* the Tons

River; and they will yield a larger quantity of spruce, which will be cut in places where the ground is stocked with poles or with younger advance growth. It will be an advantage, at an early date and sometime before these cuttings are made, to count all large deodar and spruce, say down to 6 feet in girth, available for cutting.

The distance from Chakráta is between 10 and 12 miles, and the working of this forest for Chakráta will necessitate the construction of fuel-carrying paths, which it may not be considered worth while to make unless the number of trees available is sufficiently large to justify the outlay. The timber from this forest, both deodar and spruce, might, in case it should be decided not to undertake any extensive cuttings on Government account, be utilized by allowing it to be cut gradually by the villagers who are entitled to receive such timber.

319. The area of this block is 1,463 acres, the whole of which has been protected against cattle and fires since 1869. Of this area 500 acres are estimated to be stocked, *viz.*, 250 above and 250 below 8,000 feet.

In dividing this block into compartments it will be well to keep separate the three main basins, *viz*, Bodyár, Remuwa, and Thowa, and to sub-divide each basin chiefly in accordance with the aspect of the slopes.

320. Natural reproduction of deodar in Bodyár is limited to the vicinity of the numerous belts and groups of forest, where the number of young plants is exceedingly satisfactory; they spread in all directions over the blank grassy slopes. On the left side of the Rikáni Valley, south of the Bodyár stream, a large slope, with an easterly aspect, is stocked with a dense thicket of deodar, seven feet high. These plants date back to the time before protection commenced, but their growth has doubtless greatly benefited by it.

The effect of protection in Bodyár has been an extremely heavy matting of grass, owing probably to the warm aspect, the exceptional moisture of its climate, and the rich soil (limestone mixed with shale). The grass attains a greater height here than in any of the other hill forests, and, being pressed down by the heavy snow in winter, forms a thick layer on the ground, which is almost impenetrable for the seeds of coniferous trees. This heavy matting of grass probably impedes natural reproduction; and as it will not be possible to undertake sowing and planting here on a large scale while the works in Mohna and elsewhere are going on, we recommend that a system of wounding the soil in the vicinity of all belts and patches of forest and in all other suitable localities be commenced in this block. This operation should be undertaken early in autumn, when a heavy crop of young cones is visible on the trees and before the deodar seed falls on the ground.

321. In the Bodyár block considerable progress has been made in the artificial cultivation of deodar, as explained in paragraphs 57 and 58 of the Report of 1878. A detailed examination of the localities where these operations were carried on has given the following results.

Mr. Whittall's sowings of 1872.—The plants have not made that progress which might have been expected; they are mostly yellow; the shoots of 1880 are not more than 2 to 6 inches long, and the total height of the plants does not generally exceed 3 feet. No doubt their growth might be improved by the planting of fast-growing trees, such as the blue pine, as nurses; and fortunately here and there self-sown seedlings of this tree are found among the deodar plants. But we do not consider it advisable to recommend any extensive cultural operations in this block as long as the heavy work in Mohna is in progress.

The sowings of 1875, made in patches 10 feet apart by Mr. Rind, on the south side of the Bodyár stream, present upon the whole a very favourable appearance. There are numerous plants in the patches, and the plants are about 12 inches high.

The sowings of 1877 and 1878 have succeeded well in favourable places.

A large area was planted up in 1878-79, the plants having been raised in nurseries from seed sown in 1874. Upon the whole the success of this operation has been good, but numerous plants have died, and those which survive have not made rapid progress. It is believed that the roots of these plants

were much damaged in the process of transplanting, and this experience has led to the proposal advocated in paragraph 59 of the Report of 1878, to bed out the plants in beds laid on a hard bottom, so as to prevent the formation of long tap-roots. Nurseries on this principle have been established in a well selected locality below the forest rest-house.

322. Upon the whole, the conclusion to which the examination of the sown and planted areas in Bodyár has led us is that the deodar tree, though indigenous in this forest, does not thrive while young with any vigour on the blank grassy slopes which have been operated upon. As already mentioned in the Report of 1878, there is a great difference between the hot and dry south-westerly slopes and those with a north-easterly aspect. The best plan to ensure more satisfactory progress with these plants would be to raise blue pine as nurses; but, as long as the operations in Mohna demand the attention of the Divisional Officer, it does not appear to us advisable to undertake any cultural operations in Bodyár. The progress of the plants on the ground must be watched, and, by the time that the sowing and planting have been completed in Mohna, a better system of raising deodar in Bodyár may perhaps be devised.

In the nurseries in this block about 4,000 plants, raised from seed of 1878, are available. These should be planted out next rains in lines 15 feet apart and at a distance of 3 feet within the lines, on favourable slopes with a north-easterly aspect, care being taken to keep the plants bedded on a hard bottom distinct from the others.

Choli.

323. The clearing in the Siari block, known as Choli, which was made in 1875, and is adverted to in paragraphs 38 and 61 of the Report of 1878, was visited by us on the 4th May, and we found the state of the natural reproduction as unsatisfactory as it was in 1878; here and there a few seedlings of spruce were found in places where the mineral soil had been exposed, but even these were few in number. The deodar planted out in this place in 1877 is upon the whole indifferent; many of the plants have died, and those which remain have not made much progress. The slope is moist, with a northerly aspect, and an elevation of probably about 8,500 feet; and we should hesitate to press the suggestion made in the Report of 1878 to sow it up with deodar, were it not that deodar grows immediately above the clearing, and that the patches sown in lines near the lower edge in 1877 have succeeded very well, the plants being numerous, healthy, and about 12 inches high.

We recommend that, as soon as deodar seed is available, the whole area be sown in patches, with the precaution to remove from the proposed patches all the vegetable mould, decayed leaves, herbs, and refuse wood. This should be collected in heaps and burnt, and the deodar should be sown in the ashes, which may be mixed with the soil. These patches should be made in the usual way in lines, the lines being 15 feet apart. Natural plants growing in the paths and elsewhere may be utilized by putting them out in beds and then planting them out.

Planting in Cantonments.

324. The various proposals submitted in the Reports of 1875 and 1878 for the planting up of the waste lands in the Chakráta Cantonment have resulted in the formation of a forest garden, about 30 acres in extent, on one of the easterly spurs, at an elevation of about 6,000 feet; and in the demarcation of two blocks, one opposite the forest rest-house and the other to the east of Kailána neck, aggregating 500 acres. Hence the Forest Officer's work in Chakráta will chiefly be to plant up these two blocks and to attend to the garden. The block at the north-end of Chakráta, which adjoins Mátkangra, is stocked on all northerly slopes with an incomplete forest of the grey oak, with its usual associates, *Rhododendron* and *Andromeda*, and a little moru. A commencement was made this year to sow in lines of patches, the lines being 30 feet apart. The patches were sown with acorns of the grey oak and seed of blue pine, this being the only seed available at the time.

These operations should be vigorously continued, and we recommend that, wherever there are trees on the ground sufficient to yield partial shelter, deodar should be sown, while the blank slopes with a southerly aspect should be sown up with *Pinus longifolia* and the grey oak. The soil in this block is exceedingly rich, but loose; and we recommend that particular care be paid to making the soil in the patches firm by treading it down or otherwise, so as to prevent the young plants being dried up. In order to guard against failure, it will be necessary to establish nurseries, in which deodar and *Pinus longifolia* should be raised; the plants to be used to fill up patches where the sowing has failed.

The block on the east side (Sri Toli) may be treated in a similar manner.

The chief object of the forest garden is to raise trees to be planted out in cantonments, and to test the seeds of exotic trees, so as to ascertain whether any of them will be suitable to be grown on a large scale in the station. If such can be done without interfering with the other arrangements, fruit trees may also be grown for distribution in the station and to villagers in the district.

Supply of Deodar for Chakrata.

325. Under existing arrangements, all the deodar timber required for Chakráta is brought from Konain; and this may continue, unless it should be found expedient to cut deodar in Bodyár or to cut out the old trees in Kanásar, an operation which will probably be very beneficial in promoting the development of younger trees.

The reproduction of deodar in Kanásar is exceedingly satisfactory, which may justly be ascribed to the low elevation and to the fact that the general aspect is towards the north. This forest, it will be remembered, is 1,000 feet lower than Bodyár; hence the difference in the growth of young deodar in these two places, where otherwise the conditions of soil are similar. It is probable that deodar may also be cut in the protected portion of Bájamára.

Bawar Range.

326. Under existing circumstances, the only kind of timber which is likely to find a sale to any extent in the Báwar Range is deodar. The chír forests of the northern part of the Báwar pargana, near the Tons and Pábar, are included in the Tons Division.

The most important deodar localities in this range are the Katián, Riknárgádh, and Dháragádh Forests.

Katian Forest.

327. This forest stretches from Katián and Chajár village to the outlying deodar forest of Koti, comprising the head-waters of the Bastargádh. It is situated on quartzose schists and argillaceous shales; its elevation is between 5,500 and 8,000 feet, and natural reproduction is throughout very satisfactory. In this area two blocks are protected against grazing—namely, Katián, 608 acres, and Koti, 100 acres—and a much larger area against fire. The deodar planted out near Katián in 1876 from nurseries established in 1873, and adverted to in paragraph 70 of the Report of 1878, has made excellent progress since that year; the colour and general appearance are good, and the average length of the shoots of 1880 was found to be 7 inches in the upper and 11½ inches in the lower part of the plantations. In the Report of 1878 it was stated that the success of the plants at this place was less marked than at Bodyár. This no longer holds good, for during the last few years their progress has been very satisfactory. At the same time, the ground at Katián has in many places covered itself with young seedlings of deodar, mostly due to the good seed year of 1878; and it is remarkable that these plants are found not only along roads and where the soil has been exposed, but also on grassy slopes.

The elevation of Katián is 7,000 feet, the general aspect northerly; and upon the whole the state of the natural growth of deodar is similar to that noticed in the Kanásar Forest under similar conditions, except that in Kanásar

the rock is limestone, and in Katián it is shale and schist, which is generally more favourable for the growth of young deodar.

No work is required, and none is proposed to be done in this area of deodar forest. In that portion of the Katián Forest which overhangs the village of Chajár, a large number of the old dead trees, killed by *khil* cultivation, before protection commenced are still standing. These should be utilized by supplying the wants of the villagers.

Attention is invited to the description given of these forests on pages 70 and 71 of the Busáhir Report of 1864.

Riknargadh Forest.

328. The forests on the Riknárgádh are partly in British territory, partly in Tiri-Garhwál; the upper part of those on the right bank, which are situated in British territory, is protected against fire and grazing, and the natural reproduction of deodar is exceptionally good. Of the four blocks into which the Riknár Forest is divided, deodar is found in three, *viz.*, Riknár (1,256 acres), Bomnai (2,428 acres), and Májbira (1,171 acres). The larger portion of these blocks is closed against grazing and fires, but it is not possible at present to form an idea of the deodar-producing area in this forest; but, including the portion of Tiri-Garhwál situated on the left bank of the river, it doubtless amounts to several thousand acres, and it may some day become of very great importance. Protection should be continued, and on the first available opportunity it should be made the special duty of a competent Probationer to examine these forests, to prepare a descriptive account of them, and at the same time to lay through them a system of inspection paths. It may here be mentioned that whenever a new forest is opened out by a system of inspection paths, these paths should as much as possible, in the first instance, follow existing cattle or village tracks, and these may subsequently be joined by new roads following more or less the horizontal contour lines of the hills.

Dharagadh Forests.

329. The forests drained by the Dháragádh stream consist of the wide bay at the head, the greater part of which contains deodar, and of several blocks lower down, which are chiefly stocked with chír. The total area of the blocks in this forest is 13,518 acres, of which Tutwa and Lakhau (2,260 acres) are first class forests. The total deodar-producing area cannot yet be exactly estimated, but it probably exceeds 4,000 acres. Of the deodar forests in the basin of the Dháragádh, those in the north-east corner, called Hariánta and Jáko, are on rocky precipitous ground, and are so remote that they are not likely to be of much value at present. It is different with the forests in the southern half of this large basin. Here there is a compact area of deodar forest, comprising the following blocks:—

	Acres.
Tutwa	... 825
Maura	... 714
Lakhau	... 1,435
Lakwa	... 757
Total	... 3,731

330. The general character of these blocks is this. Near the crest of the main ridge is a succession of gentle slopes, stocked with an open forest of maple, bird-cherry, and groups of the silver fir; and these slopes often extend a long way down the ravines, where, besides the trees mentioned, the mountain-birch, the walnut, and the horse-chestnut are also commonly found. Below this zone, which comprises the favourite high-level grazing grounds of sheep and goats in the pargana, and on the spurs the forest consists of a dense mass of tall trees; in the upper part, and in moist ravines and valleys, of silver fir and spruce; while the drier ridges and the lower slopes are occupied by almost pure deodar forest, which, in the southern part of the basin, particularly in Maura and Lakhau, is completely stocked with trees of large size and great height.

The following measurements will serve to illustrate the stature and dimensions of the trees in this forest :—

Maúra Block.

Aspect westerly ; altitude 8,000 feet—

	Height. Feet.	Girth. Feet.	Inches.	
Deodar	162	...		
„	144	6	2	
„	158	8	6	
„	127	7	4	
„	167	11	0	
Altitude 8,400 feet—				
Silver fir	151	...		Gentle slope.
„	183	13	0	Deep soil.
Spruce fir	200	25	4	
„	146	14	8	
„	147	14	8	

331. On the right bank of the Dogragádh there is a considerable extent of fine deodar forest, on slopes varying from 30° to 40°, with a westerly aspect. The trees are not of very great girth, but most mature trees are 150 feet high and higher. The Dogragádh takes its rise from a point on the ridge dividing the waters of the Banál and Dháragádh, about a mile west of the Karámba Peak. In other parts of the forest the gradient is steeper, and the ground is rocky and precipitous; but everywhere the forest is compact and completely stocked. Of these deodar forests an area of about 2,460 acres is closed against fire and grazing, and inspection paths have been made through a portion.

332. These forests are exceedingly valuable, because they are exceptionally well stocked, and a plan should be framed for working them economically. The timber can probably only be exported *viá* the Tons River, and the total distance down the valley of the Dháragádh to the main river is about 12 miles. It is believed that the lower course of this stream may be made fit for floating ; but, considering the small area drained by it, this will probably demand very heavy outlay for regulating the channel, so as to admit of floating during the floods of the monsoon. The question, however, should be carefully studied by a competent officer, and plans and estimates for the needful works for regulating the channel and making the slides and roads should be prepared before any final conclusion is come to on that subject. Meanwhile the protection of the forest should be continued; it should be carefully examined, and inspection paths connecting the different parts of it with the main road should be laid through it.

General. Cultural operations.

333. Planting and sowing in this division should be concentrated in as few localities as possible; nevertheless it will not be practicable to adhere rigidly to this principle during the next five years.

During this period heavy work in this respect has been proposed in the Mohna block, where it will be necessary to treat upwards of 300 acres of blank slopes by sowing and planting, and a great portion of the stocked area by systematic wounding of the soil. Simultaneously with the work in Mohna, upwards of 150 acres in the Lurli block in cantonments are proposed to be sown and planted with chír (*Pinus longifolia*) and deodar. To some extent the operations in these two blocks may be made so as to fit into each other, the work in Mohna being at elevations above 7,500 feet, while the work at Lurli block is all below 7,000 feet, and much of it at so low an elevation that it can be done during winter.

Besides these two main pieces of work, operations on a smaller scale are necessary in three other localities, viz., in Bodyár, where 4,000 deodar plants are to be planted out in July 1881; in Choli, where an area of about seven acres is to be sown in December 1881; and, finally, in Jádi, where six acres below the Chakráta road, which were cut about ten years ago, and have owing to excessive grazing not reproduced, are to be sown and planted up with spruce in autumn of the first year in which sufficient seed may be available.

The work will thus be scattered over several localities, but this is unavoidable, and arrangements must be made to fit the different pieces of work into each other as much as possible.

Coppicing of Oak.

334. In paragraph 304 of the present Report, the experiments made in the Mohna block to determine the coppicing powers of the karshu oak have been adverted to, and it has been explained that those experiments cannot be expected to give any conclusive result. It is most desirable to determine exactly how far the three oaks which form important constituents of these forests, *viz.*, karshu, moru, and bán, have the power of reproducing by coppice-shoots.

It is not likely that it will ever be found advantageous to grow either of these oaks in pure coppice woods; but it is quite possible that, in case they should be found to coppice freely, it might be found desirable to maintain the ground under coniferous trees stocked with oak coppice, and that the existence of such coppice growth would greatly facilitate the regeneration by self-sown seedlings of the coniferous forest. Instances where such has been the case are not rare in the hills of the North-West Himalaya. Thus, near Simla, the growth of deodar and chír has in several places been greatly favoured by the existence of thickets of young oak. Broadly speaking, it is probable that the oaks have much too slow a rate of growth to justify their maintenance as component parts of the high forest. But it is quite possible that oak coppice will be found exceedingly useful to nurse and foster a young growth of silver fir, spruce, and deodar.

The localities selected for these experiments should be so chosen as to contain a large proportion of poles and young trees of oak; and the cutting of these should be made with great care, so as to favour the development of coppice-shoots near the ground and of a separate system of roots. As regards the time when these cuttings should be made, it will be borne in mind that this must be done before the young foliage appears in spring, and it will be remembered that moru and bán sprout much earlier than karshu.

The selection of the plots to be thus cut over must be left to the local officer; and in order to eliminate any disturbing cause of an accidental character, it will be well to select two plots in different localities for each of the three species. These plots must of course be selected in localities protected against cattle and fire. Regarding the size of the plots, it will suffice to say that they should be large enough to give trustworthy results, and the larger the better.

Rate of growth of Oaks to be determined.

335. It has been said that the growth of these three oaks is slower than that of the coniferous trees, but this assertion is based upon incomplete data; and considering that we have not yet succeeded in distinguishing the annual rings of any of these evergreen oaks, it will now be necessary to mark off plots on which the girth of a number of oak trees of different sizes shall be periodically measured. These plots should be selected as much as possible at a medium elevation within the zone in which these oaks are indigenous, and they should contain trees as different in size as possible. Regarding other matters it will suffice to request a reference to what has been said under this head in the chapter relating to the Dehra Dún Division.

Reducing factor and annual rings.

336. Wherever fellings are made in the Jaunsár Division the opportunity should be used to determine the reducing factor of trees of different kinds and sizes. The form given in paragraphs 45 and 46 of the Report of 1875 should be adhered to.

In order to determine the rate of growth of coniferous trees by the counting of annual rings, it will be well now to adopt a uniform plan, which was first carried out in the survey of the Busáhir Forests in 1864, and which has proved to be both rapid and satisfactory. On the section of the tree on which the rings are to be counted, the first step is to find an average radius corresponding as nearly as possible to the mean arithmetical radius of the

section, and also fairly representing the differences in the rate of growth of the tree at different ages.

In trees regularly shaped it will never be difficult to select such a mean radius, and there is as a rule no object in counting the annual rings of stems which have an irregular shape. Having found a mean radius, the next step is to draw a line along it, and to mark every two inches on that line, beginning from the centre. The record should be kept in the following manner :—

Block	Mohna.
Compartment	Snow View.
Aspect	North-East.
Slope	Gentle.
Rock	Limestone.
Soil	Fair, but somewhat rocky.
Elevation	8,800 feet.
Species	Silver fir.
Total diameter	36 inches.
Bark	¾ inches.

Inches.				Rings.
2	...	...	...	11
4	...	...	...	8
6	...	...	...	10
8	...	...	...	10
10	...	...	...	18
12	...	...	...	18
14	...	...	...	19
16	...	...	...	19
18	...	...	...	14
		Tota.	...	127 years.

The number of rings from 2 to 2 inches will afford all the information that may be required.

The remarks here made in regard to the determination of the reducing factor and the counting of the annual rings apply equally to the forests of the Tons Division.

Specially instructive work for Probationers and Apprentices.

337. The current work in the Jaunsár Division, as suggested in this Report, will be of an exceedingly varied and instructive character, and it will not be difficult to employ in a useful manner, under the control of the Divisional Officer, a number of Probationers and Apprentices at the same time. We recommend that the cultural operations, including the wounding of the soil in each locality, be invariably placed in charge of an advanced student of the Forest School, and that such works as planting up small areas, as in Bodyár, Choli, and Jádi, be made the special duty of one man for each work from beginning to end as far as practicable.

Under the supervision and, where necessary, in the presence of the Divisional Officer, students may also be employed in counting annual rings and in determining the reducing factor where cuttings are made.

It will be well to place competent students for an entire season in charge of forests or blocks in which heavy work is going on (such as the Mohna and Hájawa blocks), or in charge of the special works proposed in the Dháragádh and Riknár Forests.

A very instructive employment in this division for competent students at the Forest School will be to set certain well-defined subjects for study, such as to determine the rate of growth of the coniferous trees in different localities in one block, and to give an explanation of the causes of any differences in the rate which may be observed; or to examine the condition of the natural young growth of different species in one block, and to explain the circumstances which have favoured such growth in some cases and which have hindered it in others.

CHAPTER XII.

TONS FOREST DIVISION.

Organization.

338. The Tons Division comprises the Kunigádh chír forest on the left bank of the Tons, the Deogár Forest in Jaunsár, the Dádi and Raiengarh Forests in British territory, under the control of the Lieutenant-Governor of the Punjab (leased from the Jághirdárs), the forests on the Tons River leased from the Tiri-Garhwál State, and the forests on the Pábar leased from Busáhir, the latter being under the political control of the Punjab Government. No ranges have as yet been formed, but the forests are divided into the following protective charges, which may eventually be formed into ranges :—

1*st*.—Deogár Forests, including Mandhol, with Dádi and Raiengarh—in charge of a Forester.

2*nd*.—Deota, with Bámsu, Surárs, and Dátmir, also the chír forests both in British and Native territory on the left bank of the Tons—in charge of a Forester.

3*rd*.—The Lambatách and Kotigádh Forests—in charge of a Forester.

4*th*.—The leased forests on the Pábar and Rupin Rivers in Busáhir—in charge of two Forest Guards.

339. The maps available for these forests are as follows:—for the Deota, Lambatách, Kotigádh, Surárs, and Bámsu Forests, maps on the scale of 4 inches to the mile by the Forest Survey Department; for the Deogár and Kunigádh Forests, maps on the scale of 2 inches to the mile; and for the remaining forests, the atlas sheets on the scale of 1 inch to 4 miles.

For a general account of the Deota and Lambatách Forests, reference is invited to paragraphs 4 to 30 of the Report of 1878. It will now suffice to mention that the total extent of the deodar-producing area in these two forests stands as follows :—

Forest.	Deodar-producing area.	Total area.
	Acres.	Acres.
Lambatách	1,800	2,963
Deota	2,500	5,087

Former cuttings.

340. The cuttings of deodar in Lambatách were made about ten years ago, and the total number of trees felled in all blocks was 3,600, or about two trees per acre on an average.

In Deota cuttings were made until the end of 1878 in the Partil and Temple blocks, an aggregate of 3,897 dry trees and 2,067 green trees having been felled. The proposals for the annual cuttings of the two years 1879-80 and 1880-81 were 750 trees a year, estimated to yield 52,000 cubic feet of timber. It was arranged that the fellings for these two years should be made in the Dopta and Katatách blocks, where it was expected that 1,500 trees would be available, while 70 trees more were to be felled in the Temple block.

It has, however, been found that the quantity of timber which it was considered expedient to export was obtained by cutting a much smaller number of trees, and the trees marked for felling, but not actually cut, stand as follows :—

Dopta block	846
Katatách ditto	21
Temple ditto	70

It is considered that no more trees should be cut at present in Dopta.

The cuttings have been confined to the easier slopes, and all precipitous ground has been spared; hence the difference between the number actually cut and the number estimated to be available. In Katatách fellings have only just been commenced, and it is impossible to estimate how many trees this block will yield at the present cutting.

Suggestions for the future.

341. Before submitting suggestions regarding the order in which cuttings should be made, we desire to place on record our present views regarding the principles on which the fellings of deodar should be conducted.

In Lambatách no further cuttings are contemplated. In Deota we have to deal with two classes of forest: *first*, pure deodar forest, which generally occupies all precipitous ground in the deodar zone, as well as all easier slopes with a south or south-easterly aspect; *second*, mixed deodar forest, in which the deodar is associated with spruce and silver fir, or with the moru and karshu oaks. In the pure deodar forests we have come to the conclusion that the present cutting must, as a rule, be limited to those places where young growth is on the ground, and to their immediate vicinity. Fortunately, advance growth is abundant in the deodar forests of Deota; and, as it is increasing steadily by the springing up of seedlings, we do not venture at present to recommend any but very limited cuttings of deodar where advance growth is wanting. The only other point which requires to be mentioned is that care should be taken not to clear continuous gullies and ravines, down which the snow may glide and thus destroy all young growth.

342. This method would of course be inadvisable if we had forest completely stocked with mature trees; but although the whole of the Deota Forests are exceedingly valuable, they are incompletely stocked. The treatment of mixed deodar forests must be different. The successful treatment of this class of forest will chiefly depend upon the extent to which iron-making can be carried on, so as to convert the wood of the other species into charcoal and thus utilize it. When this is not possible, no alternative remains but to kill the oaks, spruce, and silver fir by ringing or girdling. The procedure which we would advocate in this respect is to cut or kill the trees of other kinds a considerable time before the cuttings of deodar are undertaken. The object is to throw light upon the ground, and thus to cause the soil to become somewhat drier, so that when a favourable seed-year occurs the place may be speedily covered with seedlings of deodar. After this object has been attained, and after the ground is stocked with advance growth, the mature and marketable deodar trees may then be cut. In advocating the previous removal of the other kinds of trees, we do not wish to recommend that all spruce, silver fir, or oaks be cut or killed. It will suffice to remove the larger trees, leaving a proportion of poles and saplings on the ground.

These proposals, it should be distinctly understood, relate only to forests which contain a sufficient proportion of deodar. Pure forests of oak, spruce, and silver fir should in all cases be left untouched, and must remain in their present condition until iron-making has made much greater progress, or until a demand for these woods arises.

343. It will now be understood that if we recommend cuttings to be made in any particular block, this refers at present only to the forests of pure deodar, and that those portions stocked with mixed forest must wait until the procedure now suggested has been carried out. After the cuttings in Katatách have been completed, Jaurási, Kánga, and Patángni may be taken in hand in the manner here suggested. No attempt will be made to estimate the quantity of timber which may be cut in these blocks, or the number of years during which they will furnish the requisite yield of timber. As regards the quantity to be exported annually, we adhere to the conclusion arrived at in paragraph 21 of the Report of 1878, and we believe that it will be expedient to limit this quantity to from 50,000 to 65,000 cubic feet of timber per annum.

344. As regards the fellings in mixed forests, it is not expedient to lay down any fixed order in which the preparatory removal of other kinds should be undertaken. Where there is a demand for these woods for iron-making

or otherwise, it will be expedient to undertake such preparatory cuttings at once. Where there is no such demand, and where therefore the trees must be killed by girdling, such compartments must be taken in hand when it is otherwise convenient. We believe that the four blocks above mentioned will furnish the annual supply during a period of about six years. The existing slide may be expected, with the usual repairs of wood-work, to last during this period.

Natural reproduction and cultural operations.

Deota.

345. In the Partil block, where the earliest cuttings were made, the natural reproduction of deodar is on the whole exceedingly satisfactory, the only exception being a portion of compartment No. 3, where the forest was mixed and where apparently the ground has been too moist and the shade too dense. In all other compartments of this block there is not only a great mass of advance growth, but also a large number of seedlings which have sprung up, particularly after the heavy seed-year of 1878. The only places not stocked in a satisfactory manner are the moist ravines coming down from Leositách, and a number of grassy slopes with a south-westerly aspect.

In these ravines a large proportion of spruce was killed by ringing after the fellings had been made. The operation has so far been successful that the advance growth of deodar has benefited, and that the ground has become more dry; but the number of deodar seedlings which have subsequently sprung up is very small. In order to plant up at an early date those portions of the Partil block which have no deodar at present, it will be necessary to utilize the large number of plants found on the paths and elsewhere where the soil has been exposed. In many cases this can be done by simply taking out the plants and planting them during next rains. In other cases it will be desirable, in the first instance, to bed out the plants in beds prepared for the purpose, and to plant them out after they have been in these beds. The plan last named will doubtless be found most effective, and it is very satisfactory that Mr. E. McA. Moir, Deputy Conservator of Forests, the Officer in charge of the Division, had already, before the time of our visit, prepared a number of beds in suitable localities and filled them with plants taken from the forest, with a view to planting them out next rains. It is hoped that by extending these operations the whole of the blank spaces in the Partil block may be planted up in a few years.

In the moist ravines adverted to it will be necessary to clear large patches of brushwood, burning whatever can be burnt, and in these patches to plant groups of strong and large plants. The same plan may be adopted to plant up suitable places in the more open parts of the mixed forest in compartment No. 3.

346. In the Temple block cuttings were made at a later date than in Partil, and although there is a large quantity of advance growth, the number of younger seedlings is much less than in that block. This, as well as the greater part of compartment No. 3 of Partil, must be treated in the manner suggested for the mixed forests. In the four blocks in which cuttings are proposed to be made there are more grassy slopes with insufficient growth of deodar, which should be sown up as soon as a good seed-year occurs, nurseries being prepared at the same time to furnish plants to fill up failures. It should, however, be mentioned that on several of these slopes the growth of deodar seedlings is steadily progressing. We would specially draw attention to those in the Jaurási block with south-westerly aspect, which are stocked with *Rhododendron*, *Andromeda*, and grey oak, and where an abundant crop of deodar is coming up, as on the slopes of Jáko at Simla. The presence of these trees is necessary to enable the deodar to spring up, and in such places the trees of other kinds should not be touched. This remark, it is hoped, will make it clear that the treatment of mixed forest in Deota is a most delicate matter, requiring the most skilful treatment. It may here be mentioned that in the Bámsu Forest, of which we visited the western part on the 9th May 1881, the reproduction of deodar is exceedingly good. Protection from fire was commenced here in 1877, and grazing has been excluded since 1879. We are inclined to

think that this satisfactory state of things is due to the circumstance that the commencement of protection was immediately followed by the abundant seed-year of 1878.

Lambatach.

347. In Lambatách the state of reproduction of deodar is very much as was described in the Report of 1878. In the compartments at a moderate elevation, whether of a westerly or north-westerly aspect, such as Lohásu, Chakora, Garásna, and Thanwár, the slopes are covered with extensive thickets of blue pine, generally from 5 to 12 years old and up to 10 feet high. Here and there a proportion of deodar is mixed with the blue pine, particularly in the vicinity of old deodar trees; but this proportion of deodar is by no means sufficient, and unless thinnings are made, the forest will chiefly consist of the blue pine, which is without value in this locality. The terminal shoots of this tree are very long, in some places exceeding two feet.

The thinnings proposed in paragraph 10 of the Report of 1878 have not yet been commenced; they are, however, very necessary and should be carried on systematically over the whole area, wherever it is desirable to favour the growth of deodar. It should be distinctly understood that it is not intended to cut down thickets of the blue pine where there is no deodar, but only to make thinnings where it is desirable to favour the growth of the more valuable species where this is in danger of being suppressed by the blue pine. In the remainder of Lambatách the young growth of deodar is not satisfactory; there is a large extent of advance growth, which existed on the ground before the cuttings were made and protection was commenced; but, with few exceptions, there are no seedlings of younger age. The older young growth has greatly benefited by the protection against fires and grazing, but it would appear that partly owing to the heavy growth of grass or brushwood, and partly owing to the accumulation of dead leaves and rubbish, but few seedlings have come up since that time. In the two ravines of Bunárpáni and Garásna, near Durrington, spruce and silver fir have been killed by ringing over a large area. The result has been to make the ground more dry and to favour the advance growth of deodar; but there is no sign of young seedlings of this tree. The light given by this operation has produced an extraordinary growth of shrubs and brambles, which cover the ground completely. In other places extensive slopes are covered with brushwood consisting of *Indigofera* and *Desmodium*. These slopes are by no means too moist for deodar, but there is no appearance of seedlings in them. On examining the slopes covered with this kind of brushwood, one is inclined to expect to see a good crop of seedlings under the shrubs, as there is no grass and the soil is loose and open; and it is probably the heavy cover of these shrubs during and after the rains which prevents the growth of seedlings.

A third description of land which shows no reproduction of deodar is formed by the extensive grassy slopes, chiefly in the Ghoria, Dhámti, and Nonitách blocks. On these slopes hardly any trace of seedlings was to be found. In the Dhámti block a large extent of slopes was burnt in November 1878, and in places the ground is completely bared; but even here there are no seedlings. In other places numerous young trees of the blue pine were killed by the fire, the grass among them having recovered and being as thick as ever.

Operations proposed.

348. These remarks will explain that we must distinguish between three different classes of localities where cultural operations are necessary to promote the growth of deodar:—moist ravines in which the spruce has been killed by ringing; drier slopes stocked with *Indigofera*; and the vast extent of blank grassy slopes in the Dhámti and adjoining blocks.

Lambatách has been protected more or less successfully from fire and grazing since the cuttings were completed in 1873; there has, therefore, been ample time for young growth of deodar to spring up, and it would not be right to wait any longer for natural reproduction. It seems very doubtful whether, in this forest, wounding the soil alone would do much good. The experience of

the Dhámti block, where a large extent of ground has been laid bare by fire, is not encouraging in this respect; and in our opinion nothing now remains but to set on foot a regular system of sowing and planting on a very large scale. There is a fair crop of young cones on the deodar this year (1881) in this and the adjoining forests, and with care a considerable quantity of seed may be collected. Whatever amount may be available should, in our opinion, be used to stock a large central nursery, which should be established at Durrington, and the plants of which should, after having been bedded out, be used, when large enough, chiefly to plant up the moist valleys where spruce has been killed. It is not likely that there will be seed enough this year to make sowings in patches on a large scale.

Fortunately, there is an abundance of seedlings available on paths and elsewhere at lower elevations in several blocks. These should be planted out in prepared nurseries, several of which should be established near the middle level road from Durrington to Thanwár. If this operation is taken in hand at once, a supply of plants may be available for planting out during the rains of 1882 and 1883, and it will then have to be decided which localities should be taken in hand first.

349. As regards the previous preparation of the ground for planting, we must distinguish between the three classes of localities. On *grassy slopes* it will suffice to follow the usual procedure and to dig plant holes in horizontal lines, the lines being 10 or 15 feet apart and the holes being 3 to 5 feet from each other in the lines, according to the condition of the young growth on the ground. On *slopes stocked with Indigofera* it will be necessary to clear large patches between the bushes, and we recommend that in these patches groups of from 3 to 8 plants be planted. The treatment of *the moist valleys* adverted to should be similar, but the patches should be larger, and it is probable that it will be necessary to heap up the cut brushwood and dry leaves on these patches and burn them before planting. In these localities it will be necessary to use only the largest and strongest plants available, and they should never be planted singly, but in groups, as already explained.

The present condition of Lambatách is not very satisfactory, the point being that, since the cuttings were made and protection commenced, a comparatively small number of seedlings has come up. Nothing but a regular system of planting on a large scale can, in our opinion, remedy this state of things.

Chír forests on the Tons.

350. The chír forests from Hanol to Kunigadh have been demarcated and protected from fire and grazing since 1878, and the other chír forests near the Tons as far as Gaichrán have been examined and reported upon. No timber has been cut in these forests since 1871, when a quantity was exported on Government account; but offers have been received for the purchase of timber, and it is probable that it will be possible to sell a certain number of standing trees in this locality. Under these circumstances, the question arises whether this timber should be cut within the protected area or outside of it. We recommend that for the present, in the small area which has been placed under protection, the experiment be continued without interference, in order to ascertain how far the condition of the forests, and particularly the young growth of chír, will improve if protected against cattle and fires; hence it will be better not to make any cuttings in the protected blocks for the present except in those cases in which trees stand over advance growth. Outside the protected area there is no objection to more extensive cuttings. The area stocked with this description of forest is very large, and it is not heavily grazed over. It is not likely that the demand will be heavy, and for some time to come limited cuttings may be made wherever the timber may be most handy for export.

General

351. The principal work in the Tons Division will for some time to come be limited to the arrangements for the carriage of timber and the cultivation of deodar. As regards the first point, it is most desirable that, by way of

experiment, wire-rope tramways and tramways with timber carts be used, and that the system of temporary slides be perfected.

As regards the cultivation of deodar, it will be well here to state the general conclusions at which we have arrived regarding the arrangement of sowings and plantings. In planting these hill sides we propose at present to follow two different systems, *viz.*, to plant in groups in large cleared patches where the ground is covered with brushwood, and to make plant holes in horizontal lines in the usual manner on grassy slopes.

As regards sowing, we have decided to adopt the plan of vertical lines, each line consisting of separate patches at a distance of about 4 to 5 feet from each other. This arrangement has the advantage that, while the upper patch is being prepared, the ground of the lower one, on which the labourer stands, is trodden down and is thus made more suitable for the reception of seed.

In cases where neither sowing nor planting is intended, but only the wounding of the soil in anticipation of a good seed-year, we have decided to recommend the system of horizontal lines, 15 feet apart, lightly dug up.

Forests leased from Busahir.

352. The Busáhir Forests on the Pábar and Rupin Rivers, over which Government has control under the lease, were placed in charge of the Government of the North-Western Provinces by an order of the Government of India of 1869; but the first action taken by the Forest Department of the North-Western Provinces, for their control and better management, was in August 1880, when two Forest Guards were appointed. The following remarks embody the conclusions at which we have arrived on the present occasion, and the result of the observations made by the Inspector General of Forests on previous visits.

In this portion of Busáhir the lower slopes of the hills, particularly in the valley of the Pábar, are extremely bare of trees, but the surface of the hill sides is remarkably firm and well protected by a dense matting of grass. It does not seem necessary at present to take any special measures with the view of protecting the soil on the hill sides, or preventing the formation of ravines and torrents, or otherwise to guard against excessive denudation.

The country is thinly populated, and there is sufficient forest on the higher ranges and in the side valleys to furnish wood to the people for the construction of their houses and for their other requirements. There seems to be no necessity for taking special measures at present to ensure a larger supply of wood to the people of the country. Under these circumstances, it seems to us that the responsibilities of Government under the lease may be limited at present to the care of the more valuable forests, and particularly of those which produce deodar; and to making provision for the supply of wood in special cases, such as the requirements of the iron-manufacturing districts in the vicinity of Shiel.

353. These considerations point, in the first instance, to the necessity for demarcating the more valuable tracts; and outside these demarcated tracts we do not deem it advisable to enforce any restriction in forest matters, except as regards the cutting of deodar. In that part of Busáhir which is situated on the Sutlej and its feeders, *korali* cultivation and the burning of the forests have been restricted for many years past, and the effect has been beneficial. In the valleys of the Pábar and Rupin no restrictions have hitherto been enforced, and it does not seem advisable to introduce them at present. It seems preferable, in this instance, at once to undertake demarcation, and this work should be commenced at an early date. In the Sutlej—Busáhir Forests it has, in a late Report, been proposed to defer demarcation at present. But circumstances are different in those forests which are situated on the Pábar and Rupin Rivers.

The system of *korali* cultivation, *i. e.*, the practice of cutting and burning brushwood and forest for the purpose of temporary cultivation, has cleared away a large part of the lower forests; but a considerable area still remains, and a portion of this will probably be found to contain deodar. In selecting the deodar forests for demarcation and protection, it will be well not to confine the

selection to those areas which actually contain deodar, but to include within them a belt of land, especially below the forest, which may be expected eventually to get stocked with deodar.

354. Besides the demarcation of the deodar forests and of those in their immediate vicinity, we would recommend that special attention be paid to the provision of a permanent supply of fuel for the iron-manufacturing districts mentioned. We do not, however, advocate the introduction of any general restrictions in regard to the use of fuel for iron smelting at present. All we recommend is that an area of forest land in that vicinity be demarcated and placed under special protection, with a view to furnishing in the future a reserve of fuel available for the purposes of iron manufacture.

355. In other respects the only restriction to the cutting of timber by the inhabitants of these valleys outside the demarcated reserves, which we recommend at present, is that no deodar trees be cut without the permission of the Forest Officer. Great liberality should be shown in providing an ample supply of deodar timber for the construction of bridges, which, in these mountains, are essential for the maintenance of traffic.

We deprecate the introduction of any other restrictions outside the reserves, and we recommend that the local Forest Guards in charge of these forests be selected in preference from among the natives of the country. In order to facilitate the work of demarcation, we recommend that a skeleton-map be prepared on a large scale from the quarter-inch atlas sheet. The value of the skeleton-map would be greatly enhanced if the elevation of a number of places not entered on the atlas sheet could be determined and entered. Before the work of demarcation can be commenced, each deodar forest and each forest in the iron-making districts should be examined, in a preliminary manner, by a competent officer; and the preliminary report should contain an approximate statement of the area and the number of deodar trees of the larger classes in the forest.

Work on which the students at the Forest School may be employed.

356. There is less variety of instructive work for the employment of students in the Tons than in the other divisions of the School Circle, and the greater distance from Dehra Dún will make it impossible to do more than send a few of the more promising and advanced students to this division.

For these the cultural operations and thinnings suggested in the present Report; as well as the carriage of timber and the preliminary examination previous to demarcation of the forests in Busáhir, will furnish instructive employment. During the winter months much less work can be done in the Tons than in the Jaunsár Division, and it would be a good plan, whenever such may be otherwise convenient, to employ the officer in charge of the Tons Division during the slack season—that is, from the 15th December to the 15th March—to pay annual visits of inspection to the reserves of Ajmere, which are attached to the School Circle.

APPENDICES.

I.

SEPARATION OF GRAZING GROUNDS FROM TIMBER-PRODUCING AREA IN OUDH.

No. 353, dated the 7th May 1881.

From—The Secretary to the Government of the North-Western Provinces and Oudh, in the Revenue Department (Forest Branch).

To—The Secretary to the Government of India, Home, Revenue, and Agricultural Department.

In reply to paragraph 3 of your letter No. 370 F., dated the 18th June 1880, I am directed to submit, for the information of the Government of India, copy of a letter* from the Conservator of Forests, Oudh Circle, in regard to the progress made in the closing of selected blocks of forest against grazing, with a view of excluding fires.

* No. 14, dated the 23rd April 1881.

2. Captain Wood will be informed that the principle advocated in his 8th paragraph is, in His Honour's opinion, a good one, but that the proposal, as it stands, is too general; and that he should consult the District Officers in respect of the forests in each district, and then, if he thinks proper, propose a limit for each district, arranging, of course, that none of the cattle of privileged villages are excluded.

No. 14, dated the 23rd April 1881.

From—The Conservator of Forests, Oudh Circle, North-Western Provinces and Oudh.

To—The Secretary to the Government of the North-Western Provinces and Oudh, in the Revenue Department (Forest Branch).

With reference to your No. 190 of 23rd March 1881, and previous correspondence, I have the honour to report as below.

2. Accompanying is a table showing the amounts protected from fire and closed from grazing in the year 1879-80, and which have been protected in 1880-81, and which are now being protected. In all areas protected from fire cattle are excluded, except in the Charda Forest, where a small isolated portion in the northern part, 1,440 acres, and which is the furthest away from the villages, is being closed against grazing this year for the first time.

Area closed against cattle and protected from fire.

Forest Divisions.	1879-80.	1880-81.	Remarks.
	Acres.	Acres.	
Pilibhít Division	17,017	17,017	
Bhira Sub-Division	10,637	16,734	Addition No. 7, Bhira-Mailáni road W. of the waste land adjoining the former closed block.
Kheri (Trans-Sárda) Division ...	22,080	42,080	Addition E. of the Dudua home block and adjoining it. The new block will be the Kusumbha home block.
Bahraich Division	22,115	27,153	Increase principally on three sides of the Nishargarh home block, which is thus increased.
Gonda ditto	.....	.....	
Gorakhpur ditto	73,540	73,540	
Total ...	145,389	176,524	Increase 31,135 acres, or nearly 50 square miles.

3. All the additional areas protected have been approved of by the District Officers.

4. In order to inconvenience the people as little as possible, the fire conservancy blocks have been selected as far away from villages as possible; and the blocks have not been made too large, so as not to take up too great a percentage of the forest and to allow of grazing in the vicinity of the villages adjoining. All the large blocks are, when possible, looked after by a European Officer, who remains till the rains set in and makes every thing safe against fire. The areas given are only those where a regular fire conservancy establishment is kept up, but the Rambagh* block, area 2,447 acres, has been closed against grazing and fire since it was taken over by the Forest Department.

* Portion of Nawábganj Forest, Gonda.

5. In the Chakia and Sohelwa Forests (Section VIII.) lines have been made, and rest-houses and wells are being made, and the same is being done in the eastern sál forests of the Gonda Division; and when all preliminary arrangements have been made, considerable areas will be proposed to be closed against grazing and fires. In the Gorakhpur Division the whole of the reserved forests are protected from fire, and gradually the little grazing that is allowed will be confined to grass areas in the forests; but these forests differ from the forest of Oudh and Púranpur, inasmuch as when they were demarcated nearly all the grass

forests were made over to the district authorities, and the people in the vicinity have no privileges.

6. I trust that in process of time we may gradually mark off the natural grazing grounds by ditches separating them from the regular tree forests, which it is desirable to keep for the reproduction of timber; and by improving the facilities of watering, &c., we may enable a larger number of cattle to be kept on the natural grazing grounds, and thus free the tree forest from their presence. This, however, cannot be done where there are no natural grazing grounds, but only tree forest in the vicinity of villages.

7. The Inspector General of Forests has lately been over the greater part of the forests of the Oudh Circle, and has generally approved of the blocks closed against grazing and the plan taken for their extension; the subject will be dealt with in his Report on the forests of the Oudh Circle, and in two maps attached to the report will be shown the areas protected, as given in paragraph 2 of this letter. He has only recommended the increase of two small blocks: one of a few acres near Sálarpur, where there is a patch of bamboos, which are either now flowering or have seeded last year, and if the ground be not protected there will be no reproduction; and one block of about two square miles in the N. W. corner of the North Bharthapur Forest, with the Augur Ghat Nala, the Kauriála, and the Nepál border as boundaries. The Deputy Commissioner is being arranged with for the closing of these two blocks.

8. I think it might be considered whether it might not be advisable to limit the number per annum: thus for a certain number of years the grazing dues amounted at the three annas rate to some Rs. 30,000 a year; at this rate the number of cattle would be 160,000 per annum: buffaloes paid a higher fee, nine annas, so that the number would be under this figure; but I think the number might be put down as 150,000, of which a certain per-centage might be buffaloes. This number might be fixed till the grazing grounds had been fully demarcated, when it would be our interest to feed as many cattle as the regular grazing grounds would support, limiting only the number of cattle in the adjoining villages that grazed in tree forest.

II.

REST-HOUSES, OUDH.

Specification of 1st class double-storied Rest-house.

General description.—The building to be 54½′ long by 34½′ broad in the clear on the ground floor, and to have an upper story as delineated in the drawings.

The level of the ground floor to be two feet above that of the surrounding country, and the first floor to be 10 feet high from the ground floor to the ceiling, the upper rooms to be 16 feet from floor to ceiling. The accommodation on the ground floor to be as follows, *viz.*, two main rooms each 14′ × 14′, two side rooms each 14′ × 8½′, verandahs on the east and west sides, with two bathrooms, each 8½′ × 7′, at the ends of the western verandah, and a pantry 8½′ × 7′ at one end of the eastern verandah, the corner on the other end being occupied by the stair case and store-room. The accommodation on the first floor to consist of two rooms, each 14½′ × 14½′, with verandah all round. The upper story is provided in order to afford sleeping accommodation during the unhealthy part of the year, and to shade the lower story from the sun. There are to be four fire-places, one in each of the largest rooms.

Foundations.—The earth to be excavated to a depth of 2′ and a breadth 6″ greater than that of the walls. When the trenches have been properly dressed off, the bottom to be evenly covered with a layer of vitrified bricks, which is to be well rammed down into the ground. The concrete (total depth 1′ 0½″) to be composed of half-burnt kankar from the lime kiln, or, if this is not procurable, of well burnt (crooked or vitrified) bricks broken small and mixed with mortar (equal parts of kankar-lime and surkhi); after the first layer of vitrified bricks has been well rammed into the bottom of the trenches, the concrete to be thrown in successive layers of 6″ and rammed down to 4½″, or less if possible; the concrete to be constantly watered during the process of ramming. The bricks to be manufactured of the best clay procurable, and to be well burnt (pila bricks being used for out-offices, &c.), the masonry to be pucca, flush pointed with lime. The mortar to be two parts kankar-lime to one of surkhi; the surkhi to be made from well burnt bricks only.

Superstructure.—Ground floor walls 2′ thick when they carry upper story walls; otherwise they and the upper story walls to be 1½′ thick; to be of pucca bricks and katcha mortar, except the first layer of bricks over the plinth, the pillars, the flat and relieving arches, masonry near wood work for two feet, and the cornices and mouldings, which are all to be laid in lime mortar. The whole of the masonry above the plinth to be pucca, plastered both inside and outside; this not to be done in very hot dry weather. Plaster two parts kankar-lime to one part surkhi. The doors to be as shown in the drawing, in addition a window in each side room, sill 3′ from the ground, height 4½′, width 3′; in the upper rooms, windows of the same size, one in each room at the north and south ends. In the bathrooms, pantry, and store-room, windows same pattern as ventilating windows in up-stair rooms, sills at 5′ from the ground; recesses for shelves to be made in all rooms 3′ wide 4′ high, with addition of space formed by semi-circular arch, depth one foot.

Over the openings for doors, windows, and recesses there are to be single brick arches, in doors and windows raised 3″ above the middle of the chaukhats and meeting the wall flush with the tops of the chaukhats; but over the doors from the main room on the ground floor to the two side rooms there are to be wooden lintels, because the beams come directly over them. The same in the doorway between the two main rooms on the ground floor. Over the openings for doors and windows of the upper rooms there are to be flat and relieving arches, but over the small ventilating windows near the roof there are to be wooden lintels, the beams of the roof running at right angles to the beams of the ground floor ceiling. The staircase to be of pucca masonry on arches, the arches to furnish recesses in the store-room.

Flooring and terrace roof.—If the clay be good, the flooring should be of 1′ square tiles, one inch thick, on the ground floor; the flooring should be of 9″ concrete well rammed with a layer of tiles set diagonally above it; where no tiles are used, there should be an upper coating of one inch of mortar well beaten down and smoothed.

The floor of the upper rooms and roof to be supported on sál beams 6″ × 9″, three feet from centre to centre, with barghás 3″ × 3″, one foot from centre to centre; that of the verandah on karris 3″ × 4½″ at one foot from centre to centre, corner karris being 6″ × 7″. The floor of the upper rooms, verandah, and roof over two upper rooms to be terraced, 1″ of mortar or one inch tiles laid on 3″ of concrete (if square tiles are used next the barghás and karris the concrete will be 5″) over two bricks laid flat, and so placed that each upper brick or tile will break the joints of four lower ones. The upper terraced roof to have a slope of 6″ from the centre towards the north and south ends. The verandah to have a slope outwards of 1″ in 6′.

Roofing of upper verandah.—The upper verandah to have a roof of single tiles as per pattern laid on battens 1¼″ × 1½″, rafters 3″ × 4½″, two feet from centre to centre, hip rafters being 5″ × 7″, breast summers being 6″ × 6″, the roof to project so that the water from it will fall 1½′ away from the plinth of the building.

The outer edge of the roof to be supported on sál posts, the corner posts to be 8″ × 8″, and the intermediate ones 6″ × 6″.

The verandah to be enclosed by a railing of sál wood 3′ 6″ high.

White-washing.—The white-wash to be made from the best stone lime procurable, and to be of a good consistency. The whole of the masonry above the plinth to have two coats of white wash.

Beams and rafters.—To be of good sound sál timber well dressed and fitted, to be cleaned with water and coated with oil after the building has been completed.

The dimensions of some of the scantlings not before given are now given below: lintels 5″ thick, wall plates 4″ × 3″; pillar plates 2″ thick, chaukhats for doors 4″ × 4½″, and windows 3″ × 4½″; eave boards 1½″ thick, planking for shelves 1¼″ thick, railings 3″ × 3″.

Doors and windows.—The frames to be of shisham 1½″ thick, and panels of haldu 2″ thick, to be washed with water and coated with oil after they are fixed. Nine doors 3′ 7″ × 6′ 5″, two doors 3′ 1″ × 6′ 5″, five doors 2′ 7″ × 6′ ½″, one door 2′ 3″ × 6′ 2″, four windows 2′ 7″ × 4′ 1″, eight windows 2′ 7″ × 1′ 6″.

Painting.—The verandah railings, posts, and breast summers to be painted green.

Abstract of cost of 1st class double-storied Rest-house.

Quantity.	Items.	Rate.	Cost.	Total.
		Rs. As.	Rs. As. P.	Rs. As. P.
1,966 c. ft. ...	Excavating and ramming foundations...	5 0 per 1000 ...	9 13 3	
737 „ ...	Concrete	10 0 100 ...	73 11 2	
2,923 „ ...	Pucca masonry	16 0 „ ...	467 10 10	
7,356 „ ...	Kutcha-pucca masonry	13 0 „ ...	956 4 5	
1,252 s. ft. ...	Terrace flooring	10 0 „ ...	125 3 2	
1,703 „ ...	Do. roofing	13 0 „ ...	221 6 2	
638 „ ...	Do. 6″ sloped	13 0 „ ...	82 15 0	
1,692 „ ...	Tiled roofing, single	5 0 „ ...	84 9 7	
9,120 „ ...	Pucca plastering	2 8 „ ...	228 0 0	
1,744 „ ...	Painting ceilings	1 8 „ ...	26 2 6	
10,864 „ ...	White-washing	0 6 „ ...	40 11 10	
68 r. ft. ...	Hip tiling	20 0 „ ...	13 9 7	
625·05 c. ft. ...	Timbering of sál wood in position ...	1 0 per c. ft. ...	625 0 9	
396·55 s. ft. ...	Wood-work of shisham and haldu in doors and windows in position.	0 8 per s. ft. ...	198 4 4	
17½ No. ...	Sál wood railings in position ...	4 0 each ...	70 0 0	
8 „ ...	Windows and door shades ditto ...	4 0 „ ...	32 0 0	
6 „ ...	Pankhas ditto	5 0 „ ...	30 0 0	
	Clearing timber and doors with water and oiling them.	.....	10 0 0	
	Green painting railing and posts of verandahs.	.....	30 0 0	
	Nails, hooks, screws, &c.	.....	9 9 5	
	TOTAL ...	.....	3,335 0 0	
	Contingencies at 5 per cent. ...	.....	165 0 0	
	GRAND TOTAL ...	.....	.....	3,500 0 0

Specification of 2nd class double-storied Rest-house.

General description.—The building to be 38½′ long and 38½′ wide in the clear, and double storied as shewn in the drawing. The accommodation on the ground floor to be one main room 14′ × 14′, one side room 14′ × 8½′, one bathroom 8½′ × 9′, a small godown underneath the stair case, and verandahs 8½′ wide on three sides; the accommodation on the upper floor to be one room (14½′ × 14½′), with a verandah all round. There is to be a fire-place in each of the two large rooms. Materials and construction to be similar in every way to the 1st class double-storied rest-house. There will be four doors 3′ 7″ × 6′ 5″, one 3′ 1″ × 6′ 5″, and four 2′ 7″ × 6′ 5″,—total nine doors; four windows 2′ 7″ × 4′ 1″, and four 2′ 4″ × 1′ 6″,—total 8 windows.

Abstract of cost of 2nd class double-storied Rest-house.

Quantity.	Items.	Rate.	Cost.	Total.
		Rs. As.	Rs. As. P.	Rs. As. P.
1,491 c. ft ...	Excavating and ramming foundations ...	10 0 per 1000 ...	14 14 6	
559 „ ...	Concrete	10 0 100 ...	55 14 6	
2,743 „ ...	Pucca masonry...	16 0 „ ...	438 14 0	
2,593 „ ...	Kutcha-pucca masonry	13 0 „ ...	597 1 5	
981 s. ft. ...	Tiled flooring, ground floor ...	10 0 „ ...	98 1 7	
1,425 „ ...	Ditto, upper floor	13 0 „ ...	185 4 0	
342 „ ...	Terrace roofing	13 0 „ ...	44 7 4	
1,222 „ ...	Tiled roofing single	5 0 „ ...	61 1 7	
68 r. ft. ...	Hip tiling	20 0 „ ...	13 9 7	
6,722 s. ft. ...	Pucca plastering	2 8 „ ...	168 0 9	
1,207 „ ...	Painting ceiling	1 8 „ ...	18 1 7	
7,929 „ ...	White-washing	0 6 „ ...	29 11 8	
483 c. ft. ...	Timbering of sál wood	1 0 per c. ft. ...	483 0 0	
213 s. ft. ...	Woodwork in doors and windows in position.	0 8 per s. ft. ...	106 8 0	
18 No. ...	Verandah railings of sál wood in position	3 8 each ...	63 0 0	
3 „ ...	Stair case ditto ditto ...	3 8 „ ...	10 8 0	
6 „ ...	Window and door shades ditto ...	4 0 „ ...	24 0 0	
2 „ ...	Pankhas with ropes, &c., ditto ...	5 0 „ ...	10 0 0	
	Green painting railings, posts and breast summers of verandah, window and door shades and exposed sides of doors and windows.	.....	50 0 0	
	Clearing timber and doors with oil and water.	.....	15 0 0	
	Nails, hooks, screws, &c.	.....	12 13 6	
	TOTAL ...	.....	2,500 0 0	
	Contingencies at 5 per cent. ...	.....	125 0 0	
	GRAND TOTAL ...	.....	.....	2,625 0 0

Specification of 3rd class Rest-house.

General.—The inner building to be 27′ long by 21′ broad in the clear on the ground-level, the floor level will be 1½′ above the level of the ground. The accommodation to consist of two rooms each 12′ × 8′, a bathroom 10′ × 8′, and a store-room 10′ × 8′, as shewn in the drawing. The whole to be covered with a thatched shed, the flooring of which, 61½′ × 37½′, to be level with that of the inner building, the thatch projecting 2¼′ over the edge of the raised floor, making 66′ × 42′ from eave to eave. The thatch to be three feet above the tiles of the inner building.

Inner building.—The earth to be excavated to a depth of 1′ 9″, the foundation to plinth to be of burnt bricks when these are procurable, or, when well burnt bricks cannot be got, of concrete, which should be well rammed; the foundation will be composed of pila bricks or unburnt bricks with mud mortar, the concrete to be of well burnt bricks broken small in proportion of one-third of them to one of kankar-lime.

Superstructure.—The bricks to be unburnt of good clay earth, well dried, the mortar to be of mud.

Flooring.—To be either unburnt bricks laid flat and pucca plaster, or burnt bricks laid edge-wise set in lime mortar.

Plaster.—To be of mud mixed with cow-dung and bhusa, and to be left in water three days before being used.

Washing.—White-wash to be in two coats inside the rooms, outside the house to be washed with mud and water.

Tiled roof.—To be supported on round sál saplings about 1′ 3″ mid-girth, over which will rest a good stout bamboo frame, over which mats and tiles laid in mud mortar. The tiles will be common country tiles well burnt.

Sál work.—In doors and windows to be of well seasoned sál or sissu. All the poles used in the inner building and in the shed should be soaked in water some weeks before erection to prevent their being attacked by insects, wood touching masonry to be well tarred. The sills of windows on the south side to be 3′ from the floor and 3′ × 4′.

Outer shed.—Will be supported on kutcha masonry pillars and sál uprights on the outside of the floor, and on sál posts fixed into the inner building in the middle; when the bricks used are very sandy the posts should be built up inside the pillars and walls and fixed in the solid ground. The flooring to be of earth supported on the outside by a kutcha wall 2′ thick.

Abstract of cost of 3rd class Rest-house.

Quantity.	Items.	Rate.	Cost.	Total.
		Rs. As.	Rs. As. P.	Rs. As. P.
	INNER BUILDING.			
520 c. ft. ...	Earth work in inner rooms ...	2 0 per 1000 ...	1 0 0	
2,746 „ ...	Kutcha masonry	3 0 100 ...	82 6 0	
741 s. ft. ...	Tile roofing	7 0 „ ...	51 13 11	
2,806 „ ...	Plaster	0 8 „ ...	14 0 5	
2,806 „ ...	White-washing	0 3 „ ...	5 4 2	
11·78 c. ft. ...	Sál timber sawn	3 0 per c. ft. ...	35 5 5	
16 No. ...	Round timber for roof	0 14 ..	4 0 0	
6 „ ...	Doors	10 0 each ...	60 0 0	
3 „ ...	Windows	5 0 „ ...	15 0 0	
667 c. ft. ...	Digging foundation	0 2 per 100 ...	0 13 4	
	Clearing site for chauki	.....	15 0 0	
				284 11 3
	OUTER SHED.			
1,255 c. ft. ...	Outer walling unburnt brick ..	2 8 per 100 ...	31 6 0	
2,043 „ ...	Earth work in verandah	2 0 1000 ...	4 0 0	
75—1½′ middle girth...	Saplings in position	0 4 100 ...	18 12 0	
20—12′ × 2½′ Do. ...	Uprights	0 4 „ ...	5 0 0	
4—17′ × 2¾′ Do. ...	Long uprights ...	1 0 „ ...	4 0 0	
24—20′ × 1¾′ Do. ...	Ridge poles and verandah breast summers	0 8 „ ...	12 0 0	
10 No. ...	Unburnt brick masonry pillars ...	1 4 each ..	12 8 0	
1,000 „ ...	Bundles of grass	3 0 per 100 ...	30 0 0	
1 md. 20 seers ...	Iron nails	10 0 per md. ...	15 0 0	
1,000 No. ...	Bamboos	3 0 per 100 ...	30 0 0	
3 mds. 13 seers 5 chs. ...	Ban string	3 0 per md. ...	10 0 0	
31—28 s. ft. ..	Thatching	2 0 per 100 ...	62 9 0	
				235 3 0
	TOTAL ...	.....	.....	519 14 3
	Add for contingencies ...	.....	.....	30 1 9
	GRAND TOTAL ...	... ..	.....	550 0 0

III.

SUGGESTIONS REGARDING THE MANAGEMENT OF THE FOREST NEAR IKAUNA IN THE BAHRAICH DISTRICT OF OUDH, BELONGING TO THE MAHARAJAH OF KAPURTHALA; BY D. BRANDIS, INSPECTOR GENERAL OF FORESTS,—DATED (CAMP DUDUA) THE 17TH FEBRUARY 1881.

1. THE Ikauna Forest was examined in February 1881 by Mr. Pinder, Sub-Assistant Conservator of Forests, Captain Wood, Conservator of Forests, and the writer. The following suggestions are submitted as the result of this inspection :—

The forests are situated in the Bahraich District, and the area is about 16,000 acres. They consist of a long and narrow belt, extending over a length of 20 miles, from Jankinagar in a southerly direction to Lál Bojhi, the south boundary (for a length of eight miles) being formed by the Kohání Nala.

The forest consists of two main blocks, the northernmost of which is north-west of the town of Ikauna, while the southern block extends from the Kohání Nala in the south to the village of Akbarpur in the north. There are also two outlying blocks north and south of the village of Balapur. It will be convenient to call the northern main block the Ikauna block, while the southern one should be designated as the Kohání block, the two outlying blocks on the west side being called the north and south Balapur blocks.

Revenue.

2. The revenue amounts to about Rs. 3,300 yearly, of which the following are the principal items :

1*st*—Lac—Rs. 1,000 per annum. Advances are made to the Maniárs, who put the lac insect on the trees twice during the year : once in Kartic (October) and once in Boysakh (April). Half the lac collected by the Maniárs is delivered to the landlord. The lac is chiefly produced on the palás *(Butea frondosa)*, which is very common and attains a large size. We saw a large number of trees covered with lac. This item may be considerably increased by care and good management.

2*nd*—Mohwa—about Rs. 900. This tree is common in the Ikauna block, and more scattered in the Kohání one.

3*rd*—Wood for domestic and agricultural purposes. This is paid for by the inhabitants of the neighbouring villages at the rate of two annas per plough a year, and it is understood that about 200 villages avail themselves of this arrangement. It is for consideration whether this rate might not be raised. Black-smiths pay for the charcoal they require at the rate of six pies per annum for each plough for which they are responsible. Building wood is free. Firewood is free to all villagers of the Kapurthala Estates. Outsiders pay at the rate of six annas and ten annas per cart-load, which realizes about Rs. 150 a year. There is no demand as yet from outsiders for wood for building.

4*th*—Wax, fruits, harra, and kamela powder yield about Rs. 90 per annum. The collection of these articles is let to one contractor.

5*th*—Grazing and grass. The Kapurthala people pay only for buffaloes at the rate of six annas each per annum, which realizes about Rs. 200. Outsiders pay ten annas per buffalo, two annas per bullock, and one anna per cow; total realization Rs. 150 per annum. Permission to cut thatching grass has lately been let to a contractor, who pays about Rs. 30. There are extensive open plains well stocked with grass in the forest, and on one of them (Barki Jaghir) we saw a large number of people engaged in cutting the grass. This source of revenue ought to yield a great deal more than it does at present.

Recapitulating the above, we are of opinion that the revenue from lac, wood, grass and grazing may be very largely increased.

Expenditure.

3. The expenditure consists of the following items :—

	Rs.
Government assessment	3,600
Establishment (viz., Forest Munserim Rs. 30, Mohurrir Rs. 15, and 20 Chaprasis or Forest Guards at Rs. 3 each)	1,260
Total ...	4,860 a year.

Future management: survey and demarcation.

4. Many portions now included in the forest might be excluded and brought under cultivation, the rent from which would probably cover the whole of the Government assessment. The first point then to consider is, what portions of the forest are sufficiently valuable and important, for the surrounding population, to make it advisable to retain them permanently as forest; and in considering this question the greatest attention will have to be paid to the selection of convenient boundary lines. For this purpose it will be necessary to make a detailed survey and examination of the whole forest, and to enter the result of this survey on the copy of the manuscript map, on the scale of 4 inches = 1 mile, which exists in the Deputy Commissioner's office. Simultaneously with this survey, the boundaries of those portions of the forest which it may be decided to maintain permanently, should be demarcated on the ground by boundary posts, with serial numbers, and continuous boundary ditches, as has been done in the reserved forests of Oudh.

The officer charged with this survey and examination should at the same time frame and submit proposals regarding the system of roads and cleared lines which should be laid through the forest, in order to facilitate its protection and working; and he should also make definite proposals regarding those blocks which should be absolutely closed for a time, no cattle and no cutting of any kind being permitted in them.

Sál forests.

5. Those portions of the forest in which sál is the chief tree are by far the most valuable; such are a portion of the Ikauna block and the south Balapur block. In the Ikauna block much damage has been done by a contract (given three years ago) for the collection of resin (rál). All sál trees above a certain size were ringed for that purpose. Such a contract should (as a matter of course) not be given again; but if the young sál is absolutely protected, it will grow into very useful trees.

In the south Balapur block most of the old sál trees were cut down about thirteen years ago, and since then the coppice-shoots have grown to a height of 35 feet, with a girth of 15 to 23 inches. This block will grow into a most valuable forest if completely protected.

Protection.

6. Throughout the forest examined by us we found evidence that fires had been kept out during the last few years, and this accords with the statement of the Forest Munserim in charge. Nor will this be difficult, because nearly the whole forest is surrounded by cultivation. Nevertheless, all necessary precautions should be taken; and in order to make fire-protection completely certain, a system of roads and cleared lines should be laid through the forest.

After the boundaries have been demarcated and straightened by the exclusion of corners, which may be given up for cultivation and otherwise, the number of persons employed on the protective establishment may be considerably reduced. At present there are 20 Forest Guards, but a much smaller number will be found to suffice. Each Forest Guard should be responsible for a separate beat, and if such an organization is made, we believe that less than half the number will suffice. We also recommend that the Guards, whose present pay is only Rs. 3 per mensem, may, with advantage, be divided into three grades on Rs. 8, Rs. 5, and Rs. 3 per mensem, so as to hold out some prospect of promotion. Most of the present Guards are men from other districts, and we would suggest that these men should be selected as much as possible from the villagers in the vicinity of the forest. For fire-protection contracts might be made with influential men of the neighbouring villages, who might undertake the responsibility of protecting certain blocks for a certain payment to be made at the end of the season in case the forest in their charge had not been burnt.

Officer in charge.

7. The question whether eventually the Forester in charge should be a man trained at the Forest School may be left for future consideration. The revenue of these forests is capable of considerable development; and after it has increased, and after the survey, demarcation, and examination of the forest has been completed, it will doubtless be well to select a professionally-trained officer for the charge. Under existing circumstances, local knowledge, energy, and faithful service are the chief requisites.

Estimate of first outlay.

8. The cost of the survey and demarcation here proposed cannot at present be exactly estimated, but the following figures may give an idea of what is contemplated. In these figures, however, is not included the pay and travelling allowance of the superior officer whose services will be required for this purpose, as a temporary measure, say for a period of six months:—

		Rs.
(1)	Expenses of survey	600
(2)	Demarcation ditch, with posts at prominent corners, at Rs. 30 per mile, for a length of boundary estimated at 100 miles.	3,000
(3)	Thirty miles of roads and cleared lines, 15 feet broad, to replace the present meandering cart-roads, to serve as fire-lines, and to afford direct lines of communication between the principal villages on either side of the forest, at Rs. 75 per mile.	2,250
	Total ...	5,850

Control by Conservator of Oudh Forests.

9. Should it be decided by Government to lend one of the officers of the Oudh Forest Department for the survey, demarcation, and the laying out of roads, this work should be placed under the control of the Conservator; and it would be well if, during the first few years at least, the Conservator of the Oudh Forests were requested to exercise a certain supervision over the management of these forests.

IV.

PURANPUR FORESTS.

Extract from a letter, No. 245 of the 19th October 1877, from R. G. Hardy, Esq., C.S., Deputy Collector, Pilibhít, to the Collector of Bareilly.

* * * *

8. Regarding the Púranpur Forests the Conservator*(a)* proposes that a thorough survey should be made by a Forest Surveyor in company with a Revenue Officer, in order that a "settlement favourable alike to the villagers and to Government might be made." After this the Conservator would enclose as Government forests "grants Nos. 7, 8, 9, 12, 18, and parts of grants 10, 14, 15, 17, 19, 20, 21."

9. As an explanation has been called for regarding these grants, I give it here. In 1848-49 the waste lands in Púranpur, about 75,000 acres, were mapped out and divided into 22 allotments of 3,000 or 4,000 acres each. One of these allotments was a small mouzah, Mustafabad, the remaining 21 were termed grants and were apart from the malguzari area. A large number of these grants were made in 1853-54 to grantees under certain conditions; at the present time five only are held, the rest having lapsed or having been thrown up. No. 1 is held in fee simple (by purchase) by Mr. Carew, and Deve Parshad, Bhikam Singh, and Lack Singh Manai hold 16, 17, and 21 respectively. Grants 17 and 21 are the only two which are affected by the Conservator's proposals; and as far as the uncultivated lands of these grants are concerned, the grantees have forfeited all rights, they having failed to comply with the conditions under which they took the land. Government can, when it likes, resume all the uncultivated land in these grants.

10. By an order of the Commissioner of Rohilkhand, dated the 10th January 1850, extensive rights (detailed in paragraph 20 of the Conservator's letter) in all the waste lands were conferred on all Púranpur villagers, and have been enjoyed by them up to the present time, the amount of waste land being so large that no dispute appears to have arisen between them and the grantees. I have looked through several settlement papers of villages adjoining these waste lands, but find no estimate of these rights at time of assessment, so that the question, in case the forests are conserved, will be between Government and the tenants only, in which the zamindars will not be concerned.

11. As a matter of fact, the plots of land most valuable for purposes of conservation are those in which tenants have exercised scarcely any rights on account of the distance from their villages, grants 7, 8, 9, 12, 18 being all more or less remote from any villages and other forest lands lying between. The rights would of course grow more defined as the lands to be enclosed come nearer to villages, and in some of the grants mentioned in the Conservator's letter questions of grazing rights, &c., would arise and have to be settled.

12. The amount of waste land, however, is so large that I think it would be easy to secure a large area for the purpose of forest conservation without causing injustice to the villagers, and I do not see what objections could be raised to the survey proposed, in the course of which any difficulties that arise regarding rights could be heard and arranged.

V.

CONDITIONS OF WASTE LAND GRANTS, PURANPUR.

Agreement of Grant No. 1, in pargana Púranpur, Zila Sháhjahánpur, entered into by Dal Sing, son of Achal Sing, caste Rajput Toman, and Sheo Shude, son of Komnul, caste Kayeth, from May 1852 to 1901 A. D., being 50 years.

1. THE grantee is to clear, according to the undermentioned proportions, the whole tract within the period of twenty years, with the exception of 27 acres of irremediably barren land, and one-fourth, or 782-1 (A. R.), of the remaining culturable land, which is left at the disposal of the grantee, if the conditions are fulfilled.

2. If no commencement be made to clear within the first year, the settlement is to be void, and the grant resumable by Government, who may dispose of it as they think proper.

3. If 586-2-20 (A. R. P.) be not cleared and cultivated within the first five years, the uncultivated land is to be at the disposal of Government, and the grantee is to be liable to a fine of four annas for every one of the 586-2-20 (A. R. P.) remaining uncultivated.

4. If 1,173-1-20 (A. R. P.) be not cleared and cultivated in ten years, the uncultivated land is to be at the disposal of Government, and the grantee is to be liable to a fine of four annas for every one of the 1,173-1-20 (A. R. P.) remaining uncultivated.

5. If 2,346-3 (A. R.) be not cleared and cultivated in twenty years, the uncultivated land is to be at the disposal of Government, and the grantee is to be liable to a fine of four annas for every one of the 2,346-3 (A. R.) remaining uncultivated.

(a) NOTE.—Mr. G. Greig, whose Report was forwarded by Captain Wood, Conservator of the Oudh Circle, after the latter had taken over charge of the Pilibhít Division.

6. A fine incurred under any one of the three preceding clauses is to be leviable from the cleared portion of the grant in the same way as any ordinary balance of land revenue, but the person and other property of the grantee are not to be liable for it.

7. The grantee is to pay, according to the kistbandís in use in the North-Western Provinces, the following yearly jummas, viz.,—

Years, F. S.	Jumma.	Years, F. S.	Jumma.
	Rs.		Rs.
1 or 1259-60	*Nil.*	16 or 1274-75	934
2 „ 1260-61	*Nil.*	17 „ 1275-76	1,024
3 „ 1261-62	*Nil.*	18 „ 1276-77	1,114
4 „ 1262-63	22	19 „ 1277-78	1,205
5 „ 1263-64	55	20 „ 1278-79	1,295
6 „ 1264-65	100	21 „ 1279-80	1,385
7 „ 1265-66	156	22 „ 1280-81	1,475
8 „ 1266-67	224	23 „ 1281-82	1,565
9 „ 1267-68	303	24 „ 1282-83	1,634
10 „ 1268-69	393	25 „ 1283-84	1,690
11 „ 1269-70	483	26 „ 1284-85	1,736
12 „ 1270-71	573	27 „ 1285-86	1,770
13 „ 1271-72	663	28 „ 1286-87	1,793
14 „ 1272-73	754	29 to 50 1287-88 to 1308-09	1,805
15 „ 1273-74	844		

8. The right of the public road in the grant is not to be interfered with. The grantee is to pay a contribution of one per cent. per annum on the amount of his jumma for the year, in lieu of all demands of the State for aid in repairing the high roads. The grantee will have no claim on the Government for making or repairing private roads.

9. The standard of measurement is to be the British acre consisting of 4,840 square yards, and the Government shall be at liberty at any time to measure the land with the view of ascertaining that the conditions respecting the clearance of the specified portion of land, by each of the specified periods, have been fulfilled.

10. The grantee is to erect permanent boundary marks round his grant and to keep them in a state of repair.

11. The cultivated portion of the grant is to be considered a khálisa mahál, *i. e.*, an estate paying revenue to Government and subject to all conditions attaching by law to such tenures. The grantee is to be considered during the currency of the lease as the proprietor of such a mahál or estate, and subject to all the liabilities legally attaching to such persons.

12. This grant conveys a right to the land for the purposes of cultivation and to all the products of the cultivated land, but does not give a right of property in the spontaneous products of the land, or in the minerals which may lie upon or beneath the surface. Whenever any persons have been accustomed to use or consume these products, the grantee shall not interfere with them. So long as they do not trespass upon or otherwise injure the cultivated portion of the land where no customary right to such products exists, the Government, if it does not require the products itself, permits the grantee to use or to consume them, subject to such conditions as it may have imposed, or may see fit at any future time to impose.

13. For the preservation of the public peace, the grantee shall on the requisition of the Magistrate maintain a chaukidár for every 60 houses or families resident on the grant. The chaukidár shall receive for his support either 5 acres of good cleared land rent-free, or a monthly money allowance of not less than Rs. 2-8. For every three chaukidárs there shall also be maintained at the expense of the grantee a goriyat or reporter, with a jaghir of not less than three acres of good cleared land, or a monthly allowance of not less than Rs. 2.

14. The Government reserves the right which it everywhere possesses over all running streams of water, whether for purposes of irrigation or navigation, and, whenever it sees fit, can assume the control of the waters and distribute them in such manner and on such conditions as may seem most conducive to the public good. The right over these waters can only be obtained by individuals under special grant of the Government.

15. The lands included in this grant are shown in the subjoined table.

Number in Map.	Name of Grant.	Name of Grantee	Total area.	Deduct irremediably barren areas.	Remainder useful area.	Deduct one-fourth as approved by Government.	Area to be engaged.
			Acres.	Acres.	Acres.	Acres.	Acres.
1	Dal Sing Valeh...	Dal Sing and Sheo Shude.	3,156	27	3,129	782·1	2,346·3

Boundaries (as per map) ... ... North—Grant No. 2. East—Madhopur, Ghoongchaee, and Peparia Kurree. South—Dahoua, pargana Bisulpur, zila Bareli. West—Itowria, Subnagar, and Mundia.

VI.

STATEMENT OF BAMBOOS EXPORTED FROM THE KUMAUN FOREST DIVISION, AND REVENUE REALIZED THEREFROM, DURING THE TEN YEARS 1871-72 TO 1880-81.

Chaukis.	1871-72.		1872-73.		1873-74.		1874-75.		1875-76.		1876-77.		1877-78.		1878-79.		1879-80.		1880-81.		Forests whence bamboos exported, and estimated area.
	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	
		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.	
Rámnagar ...	22,742	1,289	23,114	1,422	35,170	2,212	25,851	1,661	35,951	1,312	23,240	3,012	33,062	3,047	33,080	3,010	10,760	739	21,520	2,372	The area from whence the bamboos are exported cannot be accurately given. If the Forest Survey keep any record of the area on which bamboos grow, it would be of great assistance in forming an estimate, but very often from the same tract the bamboos are exported by different chaukis, according to the requirements of the merchants.
Laldháng ...	12,884	813	2,625	1,655	25,415	1,704	13,629	864	15,550	2,000	28,062	2,110	7,998	1,031	19,147	1,389	9,599	796	19,826	1,402	
Dhelá	15,273	950	23,895	1,505	18,486	1,160	13,364	831	13,485	1,461	22,540	1,398	793	757	297	210	4,917	340	18,333	1,618	
Sawaldeh ...	3,012	184	7,736	479	9,071	643	8,591	539	9,810	635	9,731	655	9,720	621	290	200	...	...	...	...	
Máldhan ...	...	...	...	...	3,539	223	1,800	124	2,530	241	1,323	133	2	...	...	...	3,067	228	2,470	184	
Patrámpúr ...	...	...	...	...	6	...	5	1	655	33	720	48	...	...	...	...	322	22	2	...	
Barsoti ...	22	2	2,541	178	2,749	128	215	14	1,215	84	2,647	250	30,860	2,194	13,417	800	1,436	151	13,182	923	
Haldúwa ...	1,523	95	142	8	76	4	130	8	730	34	356	56	64	3	...	...	38	3	48	4	
Jálábam ...	22	1	2,571	165	7,011	432	1,429	89	1,023	89	2,818	296	85	40	900	50	1,322	102	1,582	131	
Binkheri ...	976	59	1,153	69	791	53	1,135	79	810	60	1,153	92	8	1	22	2	...	...	4	1	
Chúnakhán ...	69	4	384	19	3,740	248	778	48	780	53	482	35	...	...	...	...	...	...	...	...	
Kamolá ...	1,899	114	3,054	197	695	39	2,765	166	2,127	157	2,984	299	...	...	...	...	...	...	...	...	
Garapú ...	251	15	96	5	1,365	89	340	20	1,411	73	195	16	12	1	15	2	52	3	28	2	
Bourkbátá ...	2,762	243	2,831	260	4,337	382	3,471	314	3,413	310	2,568	229	1,013	82	1,700	90	1,038	144	996	62	
Pipal Parao ...	298	215	6,096	483	10,036	1,112	4,239	333	4,836	334	5,596	381	8,667	1,135	6,167	1,285	3,153	227	1,421	96	
Haldwáni ...	83	31	1,214	69	3,630	277	1,781	107	3,301	370	6,127	1,076	356	56	900	50	347	22	52	3	
Tándá ...	2,775	184	3,584	262	4,589	325	3,018	210	3,969	300	3,674	250	1,805	129	348	129	1,029	80	38	2	
Lálkúwá ...	301	21	1,337	100	1,825	137	1,139	82	1,634	131	1,335	84	356	54	520	60	187	33	3	1	
Horai ...	355	31	487	42	1,443	111	1,196	103	1,420	71	510	30	50	9	201	12	14	2	...	...	
Chorgalia ...	5,198	321	12,476	802	8,173	557	6,416	429	15,260	541	16,911	793	1,323	234	17,711	1,251	5,097	456	2,713	564	
Ransáli ...	1,050	105	4,158	275	27,165	511	6,781	524	7,998	715	4,057	1,311	1,900	120	3,249	135	3,631	277	2,957	257	
Sadlimat ...	8,183	558	6,107	1,099	1,068	729	5,069	351	4,178	302	3,448	308	2,256	196	3,011	211	2,298	246	3,586	354	
Kilpúra ...	11,575	1,431	57,623	4,049	29,747	2,014	11,404	197	2,737	228	5,674	448	6,977	1,162	700	316	10,384	1,221	11,984	1,411	
Jamnaghári ...	21	1	527	32	963	61	221	19	454	37	548	39	1,308	245	290	199	717	59	384	31	
Chandani ...	27,246	1,782	32,077	2,228	15,829	1,135	6,459	441	14,050	1,611	19,077	1,262	6,984	465	6,941	614	9,956	766	16,307	1,365	
Teerath ...	...	...	...	...	8	1	26	10	44	3	14	2	17	1	...	...	40	4	44	13	
Barmdeo ...	...	...	6,918	488	4,852	337	4,143	296	4,625	330	6,817	431	6,261	366	7,006	458	7,713	459	4,712	493	
Choi Parao ...	...	...	...	...	606	39	3,544	212	...	...	...	...	...	...	...	...	...	...	...	...	
Káládhúngi ...	290	127	1,981	124	1,089	71	2,010	127	2,821	120	1,891	137	...	...	...	...	...	...	6	1	
Total ...	118,810	8,576	204,727	16,015	223,474	14,734	130,949	8,199	156,817	11,635	174,498	15,181	121,877	11,949	115,912	10,473	77,117	6,380	122,208	11,290	

VII.

STATEMENT OF BAMBOOS EXPORTED FROM THE OLD GARHWAL FOREST DIVISION, AND REVENUE REALIZED THEREFROM, DURING THE TEN YEARS 1871-72 TO 1880-81.

Chaukis.	1871-72.		1872-73.		1873-74.		1874-75.		1875-76.		1876-77.		1877-78.		1878-79.		1879-80.		1880-81.		Forests whence bamboos exported, and estimated area.		
	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.	Number of bamboos in scores.	Revenue realized.		Area in square miles.	
		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.			
Kothi Ráo ...	18,869	1,145	23,325	1,441	30,353	1,860	12,315	774	16,868	1,043	11,640	729	24,954	1,625	26,376	1,755	28,399	1,849	26,434	1,715	The valleys of the Kothi Ráo and Jhirna Sot.	18	The upper portions of these valleys do not produce sufficient numbers of bamboos to induce exporters to work them.
Dháron ...	24,762	1,547	64,747	3,946	26,851	1,640	20,552	1,244	30,875	1,878	29,881	1,817	6,952	457	17,375	1,157	58,613	3,726	60,900	3,909	The valley of the Dháron Ráo	15	
Kalagarh ...	174,516	11,983	250,402	17,066	146,245	9,946	110,677	7,449	154,819	10,528	145,987	9,956	136,552	9,462	66,095	4,394	116,235	7,651	124,653	8,334	The valleys of the Rámganga River and all its tributaries, excepting the upper portions of the Sona Nadi, Mándhalti, and Kansúr.	217	Half this area is very seldom cut over. The Mundál has been only once touched, and fully 20 square miles are never cut.
Kalushahid ...	39,269	2,375	58,758	3,552	39,724	2,406	29,627	1,807	65,203	3,943	55,345	3,348	19,935	1,215	5,500	345	20,722	1,258	35,672	2,158	The valley of the Kalushahid Ráo, and the valley of the Sona Nadi above Mota Sal.	40	These valleys are all heavily worked for certain classes of bamboos; paths used by laden buffaloes are found in nearly every water-course and on all the main spurs.
Bhogpúr ...	52,640	3,180	97,037	5,888	50,237	3,044	38,000	2,295	40,491	2,440	16,037	973	7,432	447	12,698	772	30,130	1,841	24,237	1,491	The valleys of Hatea, Nalkotta, Nim Kilaoli, and Sakha Sots.	12	
Dholkhand ...	12,587	782	25,673	1,607	13,510	840	16,128	1,046	14,381	920	17,922	1,185	9,234	575	4,868	296	15,199	940	11,081	697	The valleys of the Maongadi, Dholkhand, and Goolsiga Sots.	9	
Pakh Ráo ...	42,362	2,635	61,435	3,817	25,350	1,592	32,703	2,032	51,600	3,215	40,917	2,582	11,215	747	1,058	85	19,537	1,385	19,404	1,380	The valleys of the Chupra, Kaniya, Pakhrao, and Chorpani Sots.	11	
Gújar Sot ...	16,374	1,017	29,648	1,872	19,461	1,208	15,227	940	31,348	1,933	19,448	1,205	10,417	630	722	55	12,432	844	16,659	1,103	The valleys of the Gajar Sot and Manik Rao.	9	
Bagnala ...	16,813	1,081	35,594	2,227	31,740	1,975	21,571	1,322	17,786	1,118	15,177	975	16,332	1,041	2,552	212	11,393	806	13,156	963	The valleys of the Surkhair, Ganglor, and Am Sots.	7	
Sanch ...	55,345	3,500	52,797	3,368	77,774	4,912	69,978	4,458	133,184	8,288	113,662	7,045	117,159	7,987	44,053	3,112	22,523	1,743	46,531	3,479	The valley of the Kohtri River, the upper halves of the Mándhalti and Kansúr and the left bank of the Koh River.	80	Large areas included in this are seldom cut over.
Kotdwára ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3,387	244	8,221	652	Gonjada and Gewai Sot ...	9	
Kauriá ...	32,674	2,010	53,297	3,293	46,233	2,843	31,508	1,942	40,984	2,513	28,342	1,756	27,948	1,747	10,937	708	8,549	574	18,441	1,146	Gewai and Sukrao ...	9	
Haldukháta ...	17,249	1,015	25,920	1,578	24,268	1,468	18,416	1,093	11,269	688	16,517	974	10,826	666	1,607	122	11,723	768	15,452	1,032	Sukrao and Chowkeeghata ...	5	
Pápidánda ...	108,771	6,554	161,873	9,754	96,202	5,809	82,383	4,960	88,661	5,342	61,341	3,700	55,785	3,377	29,288	1,873	81,698	4,974	63,802	3,944	Gewai, Sukrao, Chowkeeghata, Teli Sigadi, and Nalgadi.	28	
Laldháng ...	121,721	7,385	170,757	10,409	134,120	8,191	115,922	7,027	152,746	9,277	90,786	5,518	95,088	5,786	33,268	2,162	92,706	5,876	97,560	6,208	Ráwasan, Sunpani, and Luni	25	
Khara ...	60,532	3,684	88,397	5,412	84,339	5,225	79,357	4,885	92,762	5,732	82,892	5,132	66,554	4,124	26,516	1,658	18,483	2,109	29,238	2,054	Mudhal and Mithawali ...	15	
Chila ...	13,829	1,005	14,816	1,100	37,793	2,735	17,405	1,251	26,065	1,900	22,217	1,602	13,924	1,007	7,203	592	18,292	1,755	21,628	1,895	Mudhal	9	
Gori ...	93,276	6,765	70,591	5,225	105,948	7,687	93,470	6,872	92,580	6,778	76,251	5,582	76,024	5,487	22,357	1,894	55,777	5,791	86,841	8,236	Dogadda, Garapani, Bidasni, Kunaón, and Tama Khan.	35	
Luchmanjhúla	12,168	954	13,280	1,063	7,096	568	17,898	1,425	10,659	849	10,579	845	10,357	915	4,930	443	4,080	530	4,823	612	Basodhara and Khakotee ...	6	
Total ...	913,757	58,617	1,298,347	82,618	997,244	63,949	823,137	52,822	1,072,281	68,385	854,941	54,924	716,588	47,295	317,403	21,635	629,878	44,664	724,733	51,008			

VIII.

SUGGESTIONS REGARDING THE VALUATION SURVEY OF THE NAINI TAL PROTECTED FORESTS, BY D. BRANDIS, INSPECTOR GENERAL OF FORESTS,—DATED (DEHRA DÚN) THE 16TH APRIL 1881.

THE valuation survey of the Naini Tal protected forests, the estimated area of which is given at 24,000 acres, was commenced in 1879, occupying the establishment engaged on it during a period of four months. No work was done in 1880. The enumeration was made with the aid of tickets, but Mr. Dansey is of opinion—and I agree with him—that the system since developed by him in the Nindhaur Forest should be adopted.

Summary of results.

2. The results of the examination made in 1879 are recorded in the Annual Progress Report for 1879-80, and the following is a summary of these results.

Altogether the forest in 43 compartments, aggregating 6,990 acres, has been examined; and it will be convenient to arrange these compartments in two great classes, *viz.*, compartments in which cuttings may be made, and such in which no cuttings are admissible at present; and to sub-divide the compartments of the first class according to the character of the forest. This gives three classes,—forests in which cuttings may be made, and in which *Pinus longifolia* or oak predominates, and forests in which no cuttings are at present admissible.

Statement showing the compartments in which Pinus longifolia *predominates.*

Serial number of compartments.	Area of compartments.	Number of trees per acre.					Amount of grazing.
		Chír (Pinus longifolia).			Oak and other species.		
		Above 2 feet in diameter.	Between 18 inches and 2 feet in diameter.	Between 6 inches and 18 inches in diameter.	Above 18 inches in diameter.	Below 18 inches in diameter.	
	Acres.						
1	133	1·2	7·5	39·9	1·5	9·6	Heavy.
2	104	0·8	4·8	32·8	1·9	26·3	Light.
3	300	1·7	6·4	33·3	2·2	22·5	Do.
4	80	1·5	9·7	28·3	2·0	7·6	Do.
5	122	1·3	7·0	35·4	3·5	38·7	Do.
8	292	0·5	2·7	15·2	2·1	12·8	Heavy.
9	248	0·4	1·2	13·9	1·6	8·7	Do.
10	321	0·5	2·2	24·5	1·4	7·7	Light.
20	139	0·4	3·8	18·1	1·8	3·9	Heavy.
21	136	0·3	2·8	33·1	3·8	36·7	Do.
22	71	0·9	6·7	41·1	1·3	8·8	Do.
Total ...	1,946						

Statement showing the compartments in which oak and other species predominate.

Serial number of compartments.	Area of compartments.	Number of trees per acre.					Amount of grazing.
		Chír.			Oak and other species.		
		Above 2 feet in diameter.	Between 18 inches and 2 feet in diameter.	Between 6 inches and 18 inches in diameter.	Above 18 inches in diameter.	Below 18 inches in diameter.	
	Acres.						
6	233	0·5	2·7	19·5	3·5	31·4	Light.
7	354	0·4	1·8	15·3	3·4	34·3	Heavy.
12	199	0·3	0·1	2·7	13·5	24·3	None.
13	237	...	0·2	3·2	18·8	51·8	Light.
24	116	0·1	1·3	11·8	5·2	27·2	Heavy.
29	87	1·2	2·6	34·8	6·6	34·9	Light.
30	144	0·1	0·1	0·7	23·0	47·6	None.
32	203	...	...	...	23·4	48·0	Do.
33	150	0·2	0·2	...	21·4	63·3	Do.
38	219	...	...	...	19·8	63·4	Light.
39	152	0·7	1·3	2·6	18·4	47·5	Heavy.
41	393	1·8	5·2	12·8	6·6	10·8	Do.
42	161	1·2	1·9	3·1	12·6	28·8	Light.
43	154	2·0	2·7	8·6	9·6	23·0	Do.
Total ...	2,802						

Statement showing the compartments where no fellings should be made on account of excessive pasture, blanks, precipices, or for other reasons.

Serial number of compartments.	Area of compartments.	Number of trees per acre.					Amount of grazing.
		Chír.			Oak and other species.		
		Above 2 feet in diameter.	Between 18 inches and 2 feet in diameter.	Between 6 inches and 18 inches in diameter.	Above 18 inches in diameter.	Below 18 inches in diameter.	
	Acres.						
11	107	0·8	2·1	4·7	7·1	21·2	Light.
14	75	0·4	3·1	24·6	1·7	10·6	Heavy.
15	65	1·1	2·6	18·6	2·3	33·4	Do.
16	84	...	0·3	10·6	18·7	91·3	Do.
17	72	0·1	0·7	13·5	6·9	42·9	Do.
18	99	0·2	2·1	15·3	8·1	37·2	Do.
19	124	0·5	...	2·4	13·5	48·6	None.
23	89	0·1	1·2	13·2	7·3	6·5	Heavy.
25	171	...	0·2	2·7	3·4	16·1	None.
26	62	0·8	1·3	9·7	16·2	15·8	Heavy.
27	103	0·1	...	0·1	2·6	12·1	None.
28	156	0·9	0·6	4·3	5·2	16·2	Light.
31	74	0·2	0·2	0·3	22·7	44·3	None.
34	220	..	...	...	15·5	42·9	Heavy.
35	310	0·4	0·5	0·9	9·8	35·4	Do.
36	129	0·3	1·0	0·8	15·2	28·5	Do.
37	227	0·2	0·5	0·5	14·3	33·4	Do.
40	75	0·7	0·7	1·9	19·8	35·4	Do.
Total ...	2,242						

The object of making these valuation surveys has been, I understand, to determine approximately the quantity of wood which, under existing conditions, these forests may be expected to yield annually for the supply of Naini Tal.

Rights of villages.

3. The chief feature which influences the treatment of these forests is, that within them a large number of villages are enclosed, most of which, as well as a few of the adjoining villages, exercise the right of grazing, and, in most cases, also of cutting wood for their own domestic and agricultural requirements, including material for building purposes. They have also the right to lop branches, below a certain size, for winter fodder. All these rights are, I am informed, regularly recorded, and no standing tree, whether green or dead, may be cut without the permission of the Forest Officer. It may be well here to mention that these villages have no grass preserves, such as are found in other parts of the north-west Himalaya, and that during winter most of their cattle go down to graze in the Bhábar at the foot of the hills.

A small amount of grazing by the cattle belonging to the residents of Naini Tal is permitted free of payment, while the cattle kept near the station to supply it with milk and butter graze in the forests on payment of a nominal fee for the year. As may be expected, the extent to which the forest is grazed over varies extremely according to the nature of the ground and its accessibility.

Formerly, all these forests were burnt annually, but during the last five years they have been successfully protected by means of cleared fire-lines and the employment of fire-watchers.

Growing stock.

4. As regards the growing stock, it will suffice here to mention that over a large area chír *(Pinus longifolia)*, pure or mixed with oak, is the chief tree; and that in other portions, oak, rhododendron, and ayár *(Andromeda ovalifolia)* predominate. Of the oaks, bánj *(Quercus incana)* is the principal tree. In a few localities the tilonj *(Quercus dilatata)* is common, and the kharsu *(Quercus semecarpifolia)* is met with at elevations above 7,000 feet. Much less common are rianj *(Quercus lanuginosa)* and *Quercus annulata*, which last is found near water-courses.

Reproduction of the forest.

5. As regards reproduction, Mr. Dansey reports that the young growth of chír is satisfactory, even in compartments which are grazed over; but that the young growth of the oaks and other species is, as a rule, kept down by grazing. Concerning the grazing question generally, the Conservator is of opinion that the Naini Tal Forests are very lightly grazed over. A very important point is that the number of cattle which each village has a right

to graze is being determined, and will, I am informed, be authoritatively recorded. The number of cattle required to supply the station with milk and butter may of course increase, but their owners have no grazing rights.

The quantity of the annual yield of these forests, while under conservancy management, must, in a great measure, depend upon the extent to which reproduction is interfered with by the cattle grazing in the forest; and in the present state of our knowledge in this respect, as well as in respect of the rate of growth of the oak, rhododendron, and ayár, it will be an extremely difficult task to form any estimate of the annual yield.

It seems desirable that I should now place on record a few suggestions which I hope will be found useful by the officer charged with completing the examination of the Naini Tal Forests. In framing these remarks I have had the privilege of consulting Dr. Schlich, Conservator of Forests in the Punjab, as well as the Conservator of the Central Circle.

Classification of trees.

6. The existing plan of measuring the diameter should be maintained. As regards chír, it will suffice to count and record the following classes:—

Above 24 inches in diameter.
Do. 18 do. do.
Do. 12 do. do.
Do. 6 do. do.

As regards oak and all other species, I consider that for the object in view at present two classes—above 18 inches and between 6 and 18 inches in diameter—will be sufficient. We have discussed the question whether it will be necessary to record separately all the species other than chír which constitute these forests; and the conclusion which I have formed is that the oaks (all species), as well as rhododendron and *Andromeda*, may with advantage be counted and recorded separately. The great variety of trees of other kinds which are scattered in these forests, and which are most commonly found fringing the valleys and ravines, may be omitted altogether; the chief reason for this being that for the present at any rate no cuttings ought, as a rule, to be made among the trees at the bottom of valleys.

Forest at low elevations.

7. In the valleys of the Balia, the Sat Tál, and the Kuria Nadis, the forest descends below the upper limit of sál, and consists of a variety of trees different from those of the hill forests, and of a large amount of thorny scrub. Much of this area will have to be excluded from the valuation; and regarding the system to be followed in valuing the remainder, the officer in charge must use his own discretion.

Light selection fellings only are admissible.

8. In a forest which, like the Naini Tal Forest, is subject to grazing throughout, no successive fellings by compartments are possible; but the only fellings that can be made are very light selection fellings, the extent of which in each compartment must chiefly depend on position, aspect, gradient, the soil, the nature of the growing stock, and the extent to which the forest is grazed over.

In certain compartments no fellings can be made.

9. I recommend that, when examining each compartment, a brief descriptive account of the same should be drawn up; and in this Report it should be stated whether, in the opinion of the officer in charge of the valuation, any selection cuttings during the next ten years may be made in that compartment. Compartments in which no fellings can be made may be either unproductive, as on precipices or poor soil, or they may be so poorly stocked that they cannot be worked for the present, or the growth may be too young for cutting, or they may be so grazed over that reproduction cannot be hoped for. The officer in charge of the work will of course use his own discretion in not enumerating the trees in compartments in which such enumeration is obviously not required.

Estimate of annual yield for compartments which can be worked.

10. In the case of those compartments in which selection fellings are admissible, an attempt should be made to estimate the annual yield per acre, either for the entire compartment or for such portions of it as may be fit to be worked. In making this estimate, it should be borne in mind that we are working upon data which are necessarily incomplete in several essential points. We can determine approximately the growing stock on the ground; we can also determine the rate of growth of chír; but in the absence of annual rings we are, and shall for some time to come remain, ignorant of the rate of growth of the different species of oak and most of the other kinds of trees. Further, we do not possess sufficient experience regarding the reproduction of any of these species under the conditions that prevail in these forests.

Under these circumstances, clearly the only safe plan is to frame the estimate at so low a figure that it is well within the possible yield of the forests. The estimate is open to many sources of error, and we must make sure that the error is on the safe side.

Trial cuttings.

11. In order to obtain a definite idea regarding the annual yield of those compartments in which it is thought that cuttings may be made during the next ten years, it may be found useful to make a number of trial cuttings in selected compartments or portions of compartments. These trial cuttings should only comprise such trees as, in the opinion of the officer in charge of the work, may during the next ten years be cut with due consideration to the regeneration of the forest. Obviously, the treatment of chír and oak forests will be entirely different, and it will therefore be necessary to make a number of trial cuttings in pure chír forests, in oak forests, and in forests in which chír and oak are mixed. The quantity obtained by these trial cuttings in each case should be measured, and upon it should be based the estimate of the maximum annual yield of the area under conservancy management.

Order of cuttings.

12. In examining each compartment it should be noted whether the reproduction of the growing stock, or other sylvicultural considerations, render it desirable that the selection cuttings proposed to be made in it should be made at the beginning or at the end of the period of ten years,—this fact being recorded in the descriptive account of that compartment. But, in addition to this, the order in which the annual cuttings should be made in the Naini Tal Forests will have to be regulated by considerations of a more practical character, connected with the extraction of the wood and the convenience of working.

Results of the valuation survey how recorded.

13. The results of the valuation survey and examination of the Naini Tal Forests will consist of—

First,—A descriptive account of compartments, which should be specially full with regard to the state of the young growth and the effect of grazing on its development.

Second,—A brief account of the trial cuttings made and other observations taken, on which the estimate of the annual yield of the compartments to be worked has been based, and a statement of the result.

Third,—A summary statement of the recorded rights relating to the Naini Tal Forests, with a statement of the number of cattle grazing in the forest, and an estimate of the quantity of wood that will be taken from the forest in the shape of timber, fuel, and charcoal by the right-holders.

Fourth,—A summary account of the material of all kinds actually yielded by the forest and removed from it during the past three years, with explanations regarding any important fluctuations in their quantities, and with an estimate of the annual requirements which the forests will be called upon to meet during the next three years.

Fifth,—An abstract return giving a summary of the results of the valuation survey, with the estimated annual yield of each compartment in which cuttings may be made. In this abstract the compartments may be conveniently grouped in a manner similar to the statements in paragraph 2 of this memorandum; that is to say, the compartments in which cuttings are admissible will be divided into—(i) those in which chír and (ii) those in which oaks predominate.

Conclusion.

14. The above suggestions must not be regarded as intended in any way to fetter the discretion of the officer charged with the work. In the course of the examination of the forest and the trial cuttings proposed to be made, many ideas will suggest themselves to the officer, which he should develope and utilise in order to arrive at satisfactory conclusions regarding the questions at issue. But I cannot sufficiently urge the necessity of the greatest caution in framing the estimate of the annual yield, which should in all cases be well within the possible yield of the forest.

IX.

MEMORANDUM ON THE VALUATION SURVEY OF THE RANIKHET FORESTS, BY D. BRANDIS, INSPECTOR GENERAL OF FORESTS,—DATED (DEHRA DÚN) THE 18TH APRIL 1881.

Present Requirements.

THE present requirements of the station of Ránikhet are stated to amount to 95,000 maunds (of 82 lbs.) of fuel per annum to be delivered to the Commissariat. The timber requirements are insignificant, and their quantity cannot be estimated at present.

The fuel and charcoal consumed by the residents and the bazar are supplied from the forests within cantonment limits, which are estimated to cover an area of about 2,000 acres.

Those forests within cantonment limits have been protected for the last seven or eight years; they are in good condition, and it is believed that they will suffice to meet the future requirements of the station. The present remarks, therefore, relate only to the provision of 95,000 maunds of fuel a year for the Commissariat. Under existing arrangements this fuel is delivered by the Forest Department at two depôts within Cantonments, Ránikhet and Chaubattia, and is taken over by weighment. The Commissariat accept green wood of all kinds procurable in the vicinity of Ránikhet.

Forest available.

2. The forests under the Forest Department in the vicinity of Ránikhet, which must furnish this supply, are the following :—

I. The Ránikhet reserved forest, situated east of Cantonments and measuring 4,854 acres, of which it is believed that 4,500 acres may be classed as productive area.

II. The protected forests in the vicinity of Ránikhet, of which the following is an abstract :—

		Acres.
(*a.*)	Airideo	16,640
(*b.*)	Seahidevi	1,920
(*c.*)	Padoli, Dwarsaon, and Chaubattia ...	3,840
(*d.*)	Karchuli and Chilianao	843
(*e.*)	Ganiadeoli, Kathalekh, Siun, and Seoni ...	8,320
(*f.*)	Bellek	640
(*g.*)	Batronj and Machor	5,971
	Total ...	38,174

The Ránikhet Reserve is the only block which at present is protected against fire, grazing, and cutting.

The protected forests open to pasture and cutting of wood by the adjoining villages.

3. The whole of the protected forest, with the exception of two small closed blocks aggregating 640 acres, are open to pasture by the adjoining villages, particularly from April to November, and to the cutting of wood for the requirements of these villages, but not for trade; and they are burnt every year during the hot weather, generally after the 15th of May.

The number of cattle which each village is entitled to graze is being determined and recorded. As regards the wood taken from the forests by the adjoining villages in the exercise of their rights, no fixed quantity has been determined. Any person entitled to the same who requires timber for buildings and agricultural purposes makes an application to the Forest Officer, and the quantity applied for is granted in full, provided his requirements are reasonable.

The trees granted are all marked by the Forester in charge, and none but the trees marked may be cut. The number of trees cut by rightholders in 1879-80 was 6,066, aggregating about 68,000 cubic feet. About 700 trees were oak, and the remainder pine. The quantity granted in 1879-80 may be regarded as a fair annual average. The majority of trees granted for these purposes are poles from 18 to 30 inches in girth.

Valuation survey of the reserve made by Mr. Brereton.

4. With the view of determining whether the Ránikhet Reserve is capable of furnishing the whole fuel supply required by the Commissariat, Mr. Brereton, the officer in charge of the division, has made an elaborate valuation survey of the growing stock in this forest, which survey is based upon a complete enumeration of the trees of different girth classes and the determination of the cubical contents of sample trees for each class.

Cubical contents of trees.

5. In this manner the cubical contents of 116 trees have been determined, of which it will suffice to state the results as regards chír *(Pinus longifolia)*.

Girth class in feet.	Number of trees.	Average contents in cubic feet.		
		Of logs.	Of branches.	Total.
Above 8′ in girth	10	233	14	247
6′ to 8′ do.	21	121	7	128
4′ to 6′ do.	26	50	4	54
2′ to 4′ do.	27	17	1	18

It is to be regretted that Mr. Brereton has not adhered to the usual classification of 18 inches, 36 inches, 54 inches, and 72 inches in girth.

The cubical contents of the branch wood were determined by measuring all branches down to 8 inches in girth. The contents of the trunks or logs were calculated by multiplying the total length with the mean girth, which was obtained by taking the mean of the girth taken in three places—at the butt, at the top, and at the middle of the length. The figures given as the contents of the trunks are doubtless too high, and it will be readily understood that in order to obtain reliable approximate data, the trunk ought to have been measured in sections of not more than 10 feet in length. The cubical contents of the old trees above 6 feet in girth have been estimated as follows :—

Banj *(Quercus incana)*	116	cubic feet.
Rhododendron and other trees ...	61	ditto.

General results.

6. The result of this survey may be abstracted as follows :—

	Acres.
Area stocked	4,281
Area planted up	172
Area blank	391
Total ...	4,844

This area has been divided into four blocks, which are geographical divisions, and which comprise 58 compartments as follows :—

I.—Deolikhet block	832	acres	15	compartments.
II.—Dalmoti do.	2,107	„	19	„
III.—Jainoli do.	908	„	9	„
IV.—Jakhdeo do.	997	„	15	„
Total	4,844	acres.	58	compartments.

The following is an abstract statement of growing stock :—

Species.	Number of trees 6 feet in girth and upwards.	Number of trees from 2 feet to 6 feet in girth.
Chír	2,355	27,255
Oak	1,274	17,675
Other species	175	28,124
Total ...	3,804	73,054

The principal tree is chír, both pure and mixed with oak and rhododendron. The oak is almost entirely banj (*Quercus incana*), with a little phanat (*Quercus annulata*) near the ravines. Of the other trees, (*Rhododendron arboreum*) and ayár (*Andromeda ovalifolia*) are the chief, with a few utis (*Alnus nepalensis*) in ravines.

Tho total contents of the trees 6 feet in girth and upwards are given as follow :—

	Cubic feet.
Chír	376,800
Oak	140,140
Other trees	10,300
Total ...	527,240

Cubic contents of trees 5 feet in girth and upwards.

7. The examination of the rate of growth at different ages has led Mr. Brereton to the conclusion that it will be advantageous to cut the trees when they have attained a girth of 5 feet, and accordingly the total cubical contents of the trees above 5 feet in girth have been estimated, the result being as follows :—

	Cubic feet.
Chír	950,326
Oak	146,432
Other trees	41,975
Total ...	1,138,733

The very much larger aggregate cubical contents of the chír trees in girth above 5 feet is explained by the circumstance that the number of chír trees in girth between 5 and 6 feet is exceedingly large.

Reduction of cubic feet to maunds.

8. In order to reduce the cubical contents of solid wood into maunds, Mr. Brereton has made a series of experiments by which the weight of pieces of green wood was ascertained, the cubical contents of which were calculated by the square of the quarter-girth. The results obtained by him are as follows :—

Weight of one cubic foot of green wood, in lbs.

Chír	39·4
Oak	57·5
Rhododendron	41·7
Ayár	40·2

These results agree fairly with what is otherwise known regarding the weight of these woods.

Before attempting to estimate the weight of fuel contained in the total quantity of wood in trees 5 feet in girth and upwards (1,138,733 cubic feet), two facts should be considered,—*first*, that the determination of the cubical contents of the different classes has given results which are probably somewhat too high; and *second*, that the cubical contents were calculated by the square of the quarter-girth, which gives less than the solid cubical contents of wood in the proportion of 3·14 to 4. We shall probably not be far wrong on the present occasion if we allow these two sources of error to compensate each other.

Weight of wood to be yielded by the trees in girth 5 feet and upwards.

9. Thus we will accept the cubical contents quoted above as representing the actual cubical contents of the trees in girth 5 feet and upwards contained in the reserved blocks. On this assumption, the material available in maunds will be as follows :—

	Cubic feet.	Weight per cubic foot in lbs.	Total maunds (82 lbs.).
Chír	950,326	39	451,984
Oak	146,432	57	101,788
Other trees	41,975	40	20,475
Total ...	1,138,733	...	574,247

The annual demand during the last five years has, as already stated, been 95,000 maunds; hence it is evident that the present growing stock in the reserve, of trees above 5 feet in girth, can supply the needful quantity for a period of, say, six years.

Proposals for cuttings.

10. Mr Brereton proposes that the entire annual supply shall for the present be furnished from the reserve, and that when the existing stock in that forest is exhausted the protected forest should be drawn upon until the younger growth in the reserve has attained maturity. This assumes that the young growth throughout the reserved block is so complete and so far advanced that the cutting out of the whole of the larger trees within the next six years is admissible and desirable. From Mr. Brereton's description of the compartments I am inclined to doubt whether this is the case, and I feel sure that it will be safer to cut out the larger trees from the reserve more guardedly. The young growth of chír in many compartments is said to be fair, while in some it is said to be good; and chír certainly requires abundance of light while young. But even in the case of this tree it will probably be found that the removal of the large trees had better be done gradually. The young growth of oak and other trees is said to be, with few exceptions, scanty; and if it is intended to encourage the reproduction of these kinds, the shade of older trees is necessary.

Mr. Brereton does not indeed propose to cut down at present the whole of the trees five feet in girth and upwards, but to leave a portion standing for seed and in ravines; and he proposes to make up the deficiency in the annual yield from thinnings and by utilising windfalls and trees under five feet in girth which may be decaying. Nevertheless, the plan proposed by him contemplates the removal of the larger trees in a shorter time than I am inclined to think is justified by a due regard for the development of the young growth.

The growing stock in the reserve must be made as complete as possible.

11. There can be no doubt that when completely stocked with a perfect gradation of ages, 4,500 acres of productive forest on gentle slopes and upon the whole on good soil, at an elevation of 5,000 to 7,000 feet, should be capable of yielding 95,000 maunds, or (roughly speaking) 190,000 cubic feet, which amounts to 42 cubic feet

per acre per annum. But in order to ensure the whole area getting stocked completely, its treatment should be so arranged as to favour the development of the young growth as much as possible, and the annual cuttings in each compartment should be made with the special object of promoting the development of the young growth.

The rules and principles which should regulate these cuttings, so as to effect the object in view, must be based upon a further examination of each compartment in detail; and until that examination has been completed, it will be safest to fell sparingly.

Cuttings must be made in protected forests.

12. Under these circumstances, it is clear that until the reserved forests near Ránikhet have been brought to such a state as to furnish the whole supply permanently, it will be necessary chiefly to draw it from the protected forests.

Seoni Forest.

13. The most important of these forests for this purpose is that called Seoni. It is traversed by the cart-road, which enters it at a distance of 11 miles from the Ránikhet depôt and 15 miles from Chaubattia.

At present the whole fuel delivered at Ránikhet is carried upon men's backs, and with this mode of carriage a distance from the depôt of more than six miles is considered prohibitory at the present rate of sale, which is Rs. 34 for 100 maunds of 82 lbs. delivered at the Commissariat godown. Cart hire is as yet very expensive at Ránikhet, but it is probable that if matters are organised efficiently, with the aid at the outset of Government carts, it will be possible to deliver the fuel from the Seoni Forest at a rate not much higher than that paid for the wood from the reserve. It would not, however, be expedient to supply from this forest the Chaubattia depôt, which is four miles further than the Ránikhet depôt. Two-thirds of the total supply at present goes to the Ránikhet depôt and one-third to Chaubattia.

Growing stock of Seoni Forest.

14. The area of the Seoni Forest is 4,480 acres, and of this area a complete examination has been made on 3,200 acres, which has given the following results:—

Species.	Number of trees 6 feet in girth and upwards.	Number of trees from 2 feet to 6 feet in girth.
Chír	3,404	70,716
Oak	4,316	19,321
Other species	1,047	22,432
Total ...	8,767	112,469

These figures show that this forest is much better stocked with trees of all classes than the Ránikhet Reserve. The reproduction of chír and oak, however, is very poor at present on account of the heavy grazing and annual fires.

The quantity of wood given from the Seoni Forest to the adjoining villages is insignificant, it having amounted in 1879-80 only to 523 trees of chír and 396 trees of oak, all poles and small trees, aggregating only 8,448 cubic feet. A small quantity of timber has been felled annually during the last two years for the station, as well as for the Seoni Brewery, and all further requirements of building timber for Ránikhet must, it is expected, be supplied from this forest.

If large cuttings are made, cattle and fire must be excluded.

15. As regards soil and elevation, this forest is similar to the Ránikhet Reserve, and the species are the same. If it should be decided to make extensive fellings in the Seoni Forest, in order to provide Ránikhet with timber and fuel, its condition will deteriorate rapidly unless the compartments cut are closed against grazing and fire. Hence it is for consideration whether a portion of this forest may not be closed against grazing and fire, on the understanding that the villages entitled to pasture shall be at liberty to cut the grass in the closed portion. The experience of the small closed blocks in the adjoining forests and in the Ránikhet Reserve shows that the growth of grass under protection from fire is exceedingly heavy, and as far as the quantity of fodder available for their cattle is concerned, the villages in question would gain by the arrangement.

It is of course most desirable in all cases to make forest conservancy as little inconvenient as possible to the people concerned, so as to secure their co-operation in the work of protection,

instead of making them enemies. Under the arrangements proposed, the people will at least gain as much as they lose.

The grass in the closed compartments might be cut and used for winter fodder.

16. The increased supply of cattle fodder in the protected blocks in the Ajmere and Merwára Hills is now appreciated as a great advantage by the people in their vicinity. It is of course out of the question to close the entire area, and to expect all the villages in the vicinity to cut the whole grass which they require for their cattle; but by way of experiment it may perhaps be advisable to close those compartments in which cuttings have been made.

Or the forests might be regarded as the village grazing grounds.

17. I am not acquainted with the arrangements made by the villages near Ránikhet for providing their winter supply of cattle fodder, but it may not be out of place here to mention that in the Simla Hills each village has one or several grass preserves (ghain or ghasni). These preserves occupy extensive slopes on the hills; no cattle are permitted to graze in them until after the grass has been cut in autumn, and then the crop of grass is cut and stored for winter fodder. Perhaps it may be possible to induce the people in the Ránikhet Hills to utilize the grass in the closed blocks for winter fodder in a similar manner. If it should not be considered advisable to accept this suggestion, then the only alternative would be to treat these forests as grazing grounds, and to cut whatever wood or timber may be wanted for the station without regard for reproduction. The small requirements of the villages in the matter of wood or timber could always be provided for by reserving certain blocks, in which no cuttings for the station would be made. The consequence of accepting this alternative, however, would be that the forest would deteriorate and could not be depended on for providing the station with building wood in future. In that case the building wood for Ránikhet would have to be brought up from the sál forest of the Kosi valley. The villagers having vested rights in these forests, the supply of their requirements to the extent of these rights must be considered in the first instance; and rather than interfere with the exercise of these rights, it may be necessary to bring up the timber and fuel for the station from the forests of the Kosi valley.

Other protected forests.

18. Besides the Seoni Forest, those mentioned in the following statement are sufficiently near to Ránikhet to be regarded as convenient sources for the supply of fuel, and it will now be expedient to review the resources of all forests which are available for this purpose. In this statement the number and cubic contents of trees above 6 feet in girth have been estimated in the following manner:—

The total area of Seoni (4,480 acres) has been assumed to contain the same quantity of timber per acre of the different classes as the 3,200 acres of which a complete enumeration has been made. The other forests in the vicinity of Ránikhet (8,523 acres), being poorly stocked, have been assessed at half rates. The cubic contents of the trees above 6 feet in girth have been taken at the rates determined by Mr. Brereton for the Ránikhet Reserve.

Cubical contents of trees above 6 feet in girth.

Name of forest or block.	Area.	Number of trees.		Average contents per tree in cubic feet.	Total contents.	Total contents of all species per forest or block.
		Species.	Number.			
	Acres.					
Seoni	4,480	Chír ...	4,766	160	762,560	1,440,010
		Banj ...	6,042	100	604,200	
		Other species ...	1,465	50	73,250	
Padoli, Dwarsaon, and Chaubattia	3,840					
Karchuli and Chilianao ...	843	Chír ...	4,534	160	725,440	1,370,090
	8,523	Banj ...	5,749	100	574,900	
Ganiadeoli, Kathalekh, Siun	3,840	Other species ...	1,395	50	69,750	
Total ...	13,003		23,951			2,810,100

Material available in the reserve and in the protected forests.

19. From these figures the weight in maunds of the timber now standing on the ground, contained in the trees 5 feet in girth and upwards, has been calculated according to the proportions ascertained by Mr. Brereton in making the valuation survey of the Ránikhet

Reserve. The following figures include also the timber estimated to stand in the Ránikhet Reserve :—

Growing stock of trees in girth 5 feet and upwards in maunds of 82 lbs.

Name of forest.	Chír.	Oak.	Other species.	Grand total of all kinds.
Seoni	914,309	424,510	145,768	1,484,587
Other protected forests	870,528	404,925	138,803	1,414,256
Ránikhet Reserve	451,984	101,788	20,475	574,247
Total ...	2,236,821	931,223	305,046.	3,473,090

The present mature growing stock will furnish the requisite outturn for 36 years.

20. The matter then stands thus—that the stock of timber in girth 5 feet and upwards in the forests mentioned may safely be estimated to contain 3,500,000 maunds of wood, which is sufficient to furnish 95,000 maunds a year during a period of 36 years. Thinnings and the younger trees now on the ground, which during this period will attain a girth of 5 feet, will furnish the annual yield for a further period, the length of which however cannot now be estimated.

It is also out of the question at present to attempt any estimate of the number of years which will be required to bring the 4,500 acres of productive area in the Ránikhet Reserve into such a condition that the growing stock will be complete, and that the area will be equal by itself to furnish the wood required by the Commissariat. But it seems not unreasonable to expect that, at the expiration of 36 years, considerable progress will have been made in attaining this end. With strict protection combined with cautious and judicious cuttings, and sowing or planting where needed, there is no ground to doubt that within a few years the entire area of the reserve will be stocked with young growth of chír and oak; and this end once attained, the only question will then be, whether these trees grow with sufficient rapidity to form a complete forest before all the mature timber has been cut.

Regarding the rate of growth of the oaks and other kinds of trees, nothing whatever is known at present.

21. Regarding the rate of growth of chír, Mr. Brereton has examined the number of rings for each inch of radius from the centre to the circumference at the butt end of 12 trees. Three of these trees show a very irregular and erratic rate of growth. Excluding these and grouping the number of rings counted on sections of radius of three inches, the following results are obtained. In these figures the thickness of the bark has been assumed at half-an-inch throughout :—

Girth.	*Age.*
18 inches	33 years.
36 do.	68 do.
54 do.	114 do.
72 do.	164 do.

The details are shown in the statement below :—

Examination of annual rings, chír, Ránikhet Reserve.

Serial number of tree.	Rings counted on sections from centre to circumference.			
	0-3 inches.	3-6 inches.	6-9 inches.	9-12 inches.
2	50	35	31	52
3	56	38	48	...
4	25	18	20	26
5	35	28	33	48
6	56	57	83	79
8	19	23	29	33
9	30	23	...	...
11	35	55	57	...
12	57	57	83	79
Total ...	363	334	384	317
Average ...	40·33	37·11	48·00	52·83

These figures indicate a much slower rate of growth than might be expected under the circumstances; but it must be remembered that the trees examined have grown up under the

influence of the annual fires, and that under protection from fire the soil will improve, and a much more rapid rate of growth may be expected.

General considerations.

22. The data now before us do not justify any but a very general view of the question; but so much seems evident that, if cuttings can be extended to the whole of the forests mentioned above, and if cuttings in the reserve are made solely with regard to the development of the young growth in it, there is sufficient material within a reasonable distance of the station to provide for its requirements until the Ránikhet Reserve alone shall be capable of furnishing the whole supply. Undoubtedly it is preferable to organise the management of those protected forests in which cuttings are proposed to be made, so as to secure to them a complete growth of young timber. As already explained, such a system will be compatible with the interests of the villages having rights in these forests, and will at the same time provide a larger annual supply of timber and fuel than can ever be expected from the Ránikhet Reserve of 4,500 acres productive area. And this is of course a matter of very great importance in case it should hereafter be decided to increase the station of Ránikhet.

Proposed arrangement of cuttings.

23. Taking all these circumstances into consideration, it seems to me expedient that during the next two years (1881-82 and 1882-83), that is, to the 1st April 1883, the fuel required to supply the Commissariat should be cut in somewhat like the following proportions in each of the forests named :—

Name of forest.	Average distance from depôt in miles.	Quantity in maunds.
Reserved forest	3½	24,000
Seoni	13	50,000
Chaubattia	4	15,000
Padoli	3	6,000
Total		95,000

The wood from the Seoni Forest will have to be carted up to Ránikhet; that from the other forests will, as at present, be carried upon men's backs. This arrangement of cuttings seems at present the safest that can be desired. Mr. Brereton thinks that the supply contemplated to be drawn from the Ránikhet Reserve during the next two years, in accordance with these suggestions, may be provided by cutting out chír trees standing in the midst of good young growth, and hollow and decaying oak trees where they are not required to shed seed. Further, that these cuttings during the two years in question should commence in the Chaubattia block; and that if this block should be found not to yield a sufficient quantity, the cuttings should be extended to the Janauli block.

Data to be collected for a regular working-plan.

24. In order to prepare a regular working-plan for the period following the two years for which provision has been made, it will now be necessary to study the following questions :—

First.—As regards the protected forests, what portions may be closed against pasture, provided the villagers are permitted to cut grass.

Second.—In the reserved forest, how should the cuttings and management be arranged in order to secure the ground being completely stocked with young growth in as short a time as possible, and to form to some extent a regular gradation of ages.

With regard to the last point, it should be borne in mind that it may be necessary always to continue a system of well regulated selection fellings, and that it may not be advisable ever to adopt a system of successive fellings by compartments in this forest. What I mean is, that it may perhaps not be found necessary at all to establish a regular gradation of compartments, stocked with forest of different ages, in the Ránikhet Reserve. The consideration of this and other sylvicultural questions will doubtless suggest itself to the attention of the officer who may be deputed to make this enquiry in company with the officer in charge of the Division.

X.

MEASUREMENT OF RINGS, JAUNSAR, MAY 1881.

Mohna Block.

SOUTH KATBAU COMPARTMENT.

Spruce Fir.

Aspect—N. E.
Slope—gentle.
Soil—deep.

Altitude—8,500 feet.
Diameter—28 inches.
Age—61 years.

Bark—½ inch.

Spruce Fir.

Aspect—N. E.
Slope—gentle.
Soil—deep.

Altitude—8,300 feet.
Diameter—32 inches.
Age—114 years.

Blue Pine.

Slope—moderate.
Aspect—N. E.
Soil—good.

Altitude—8,400 feet.
Diameter—15 inches.
Age—40 years.

EAST SNOW VIEW.

Spruce Fir.

Aspect—N.
Slope—gentle.
Soil—fairly deep.

Altitude—9,000 feet.
Diameter—36 inches.
Age—147 years.

Silver Fir.

Same conditions.
Soil—somewhat rocky.
Altitude—8,800 feet.

Bark—¾ inches.
Diameter—36 inches.
Age—127 years.

Hajawa Block.

COMPARTMENT 3.

Spruce Fir.

Aspect—N. W.
Slope—gentle.
Soil—deep.

Altitude—9,000 feet.
Bark—½ inch.
Diameter—33 inches.

Age—167 years.

COMPARTMENT 1.

Spruce Fir.

Aspect—N. E.
Slope—rather steep.
Soil—deep.

Altitude—8,500 feet.
Diameter—22 inches.
Age—131 years.

COMPARTMENT 2.

Silver Fir.

Aspect—N. E.
Slope—gentle.
Soil—deep.

Altitude—8,500 feet.
Diameter—40 inches.
Age—178 years.

Maura Block.

Deodar.

Aspect—W	Altitude—8,000 feet.
Slope—44°	Diameter—13½ inches.
Soil—fair.	Age—56 years.

XI.

NOTES ON AN INSPECTION OF THE MANDHOL FOREST MADE IN MAY 1881, BY E. McA. MOIR, DEPUTY CONSERVATOR OF FORESTS.

THE Mandhol first class Forest, situated in the Deogár Range of Jaunsár Bawár, consists of the following blocks—Pushrár, Lambidhár, Chumba, Morutách, and Burách; and comprises an area of 3,662 acres. The first of these blocks, which occupies the western slope of the Lambidhár ridge, possesses a much drier soil than is found in any part of the rest of the forest, with the exception of the lower portion of the Burách block, where similar soil is found.

The central portion, comprising Lambidhár, Chumba, and Morutách, consists of a well-defined basin drained by the Chándi Gádh; in the greater part of this area, as well as in the upper portion of Burách, the soil is extremely moist. The rock is principally clay-slate, gneiss, and shale. The elevation varies from 7,600 to 9,400 feet.

The forest vegetation in the large central basin and in the upper part of Burách consists principally of rai *(Abies Smithiana)*, morinda *(Abies Webbiana)*, deodar, and chil *(Pinus excelsa)* in about equal proportions, but, previous to the felling operations, deodar probably here formed a third part of the crop. The upper part of the Pushrár block is a pure deodar forest, while the lower parts of this block and of Burách are an open forest of deodar, bán *(Quercus incana)*, ayár *(Andromeda ovalifolia)*, and rhododendron. During 1868, 1869, and 1870 heavy fellings took place over the whole of the forest, except in the more inaccessible parts, and in the lower portions of Pushrár and Burách, where the trees were as a rule small and scattered. A considerable portion of the forest was examined by Mr. McA. Moir on the 21st, 22nd, and 23rd May 1881, when the following observations were made.

As already explained, the soil in the larger portion of the forest is very moist, and before fellings commenced there must have been a considerable growth of *Indigofera* and other shrubs on the ground. On the other hand, the soil in Pushrár and in the lower part of the Burách block being much drier, the conditions there were not so favourable for the springing up of a dense undergrowth.

As a rule, the fellings of 1868, 1869, and 1870, especially in the Morutách and Lambidhár blocks, seem to have been too heavy, there being few seed-bearing trees left, and it is not now known whether at the time the fellings were made the soil was in a fit condition to receive the seed. The result of this severe felling, added to the extreme dampness of the soil, has been that a dense growth of *Indigofera*, *Desmodium*, poplars, ayár, brambles, balsams, ferns, and grass has sprung up which has not only prevented the germination of deodar seed, but, as a rule, has effectually hindered the growth of spruce and other kinds. In some places, however, there is a fine show of young trees, consisting of deodar, spruce, and silver fir, probably about 12 or 15 years old, which must, therefore, have existed before the cuttings were made. In places, such as on dry rocky ridges, where the old trees are branchy and therefore not suitable for felling, a considerable growth of deodar seedlings from 3 to 5 years old may be seen. In the higher portions of these blocks, where the soil is drier, and also in Pushrár, a very vigorous growth of deodar is to be seen that has evidently greatly benefited by the cutting out of the old trees, but few young seedlings are to be met with, except in strawberry beds and other dry places. In the lower portion of Pushrár and Burách no fellings were made, there being only a few small scattered deodar trees mixed with oaks and rhododendron. In this part of the forest also the grass is not very dense, and a fine growth of seedlings, principally of 1878, is to be seen, the greater number being along the paths.

In the upper portion of Pushrár a place was examined where a severe conflagration took place in 1869 or 1870, in which it is stated that the chips, logs, and standing trees, and the soil, remained burning for at least a fortnight. The result now is that the little soil that was left is now covered with a dense growth of poplars, willows, and brambles, and only a few deodar plants near the edges are observed. The absence of deodar seedlings may be due to the fact that all the seed-bearing trees were burnt in the general conflagration.

As regards cultural operations in this forest, the following work has apparently been done under the direction of Mr. Bagshawe.

In certain blank spaces in the Lambidhár and Pushrár blocks, about 5,000 pits were sown with deodar seed in November 1878, but the result has not been satisfactory, for in 300 pits examined in Lambidhár only 10 or 12 plants were found. In the Pushrár block, the area sown was subsequently rooted up by pigs.

The ringing of about 3,000 or 4,000 spruce and silver fir was also undertaken in 1879, only trees standing over young advance growth of deodar having been operated upon. The result has been most satisfactory, and reflects great credit on the officers by whom it was executed. The lopping of young spruce was also effected where mixed with deodar, but the young trees have again thrown out vigorous shoots, which are now nearly as high as the deodar plants.

Suitable sites for two nurseries have been selected, and the rearing of seedlings for future planting operations will be taken in hand as soon as possible.

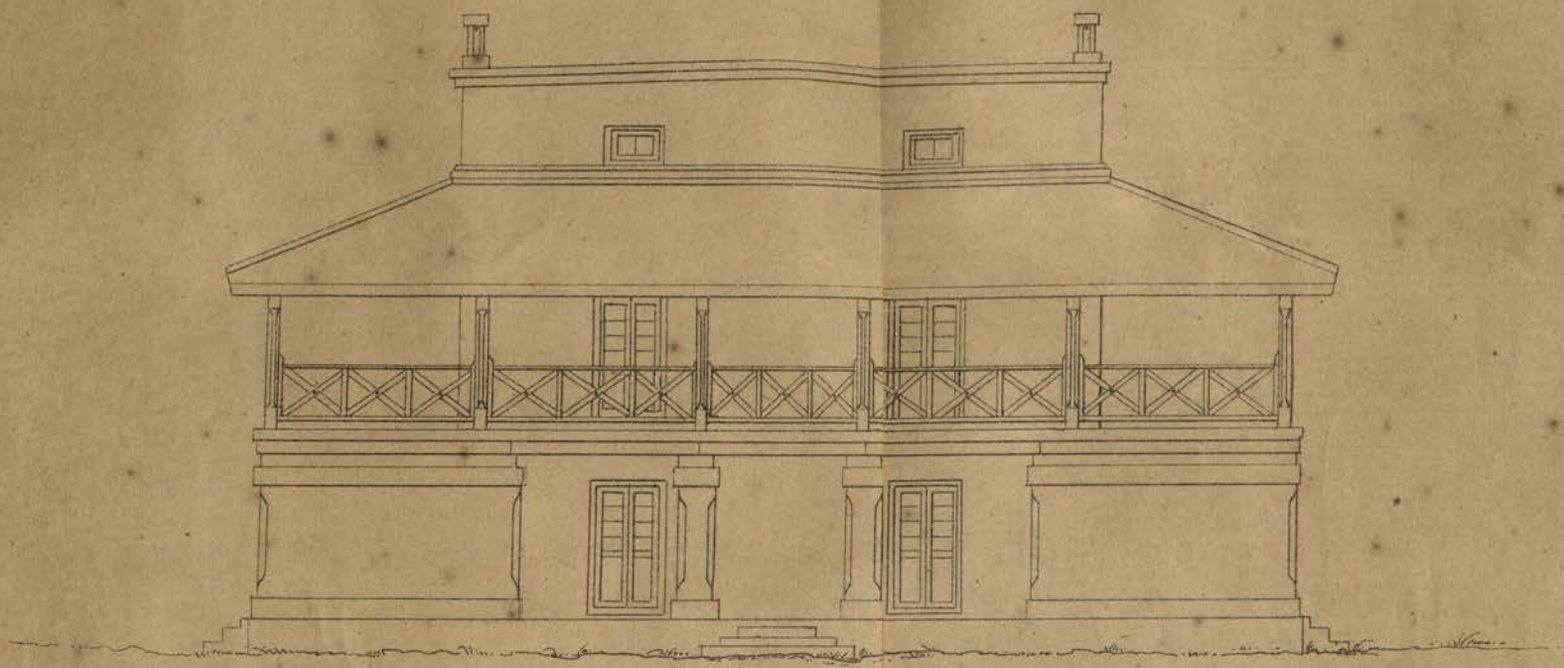
PLAN AND ELEVATION

OF A

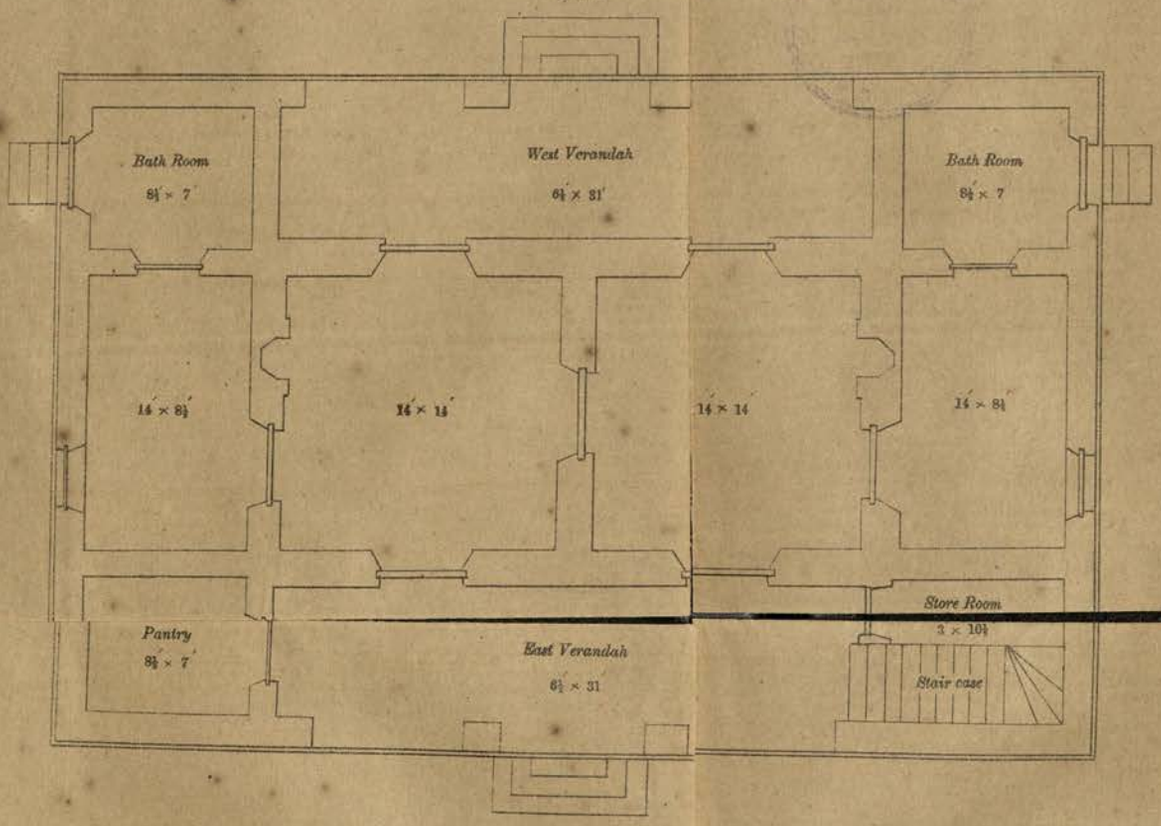
1ST. CLASS DOUBLE-STORIED REST HOUSE

Standard Pattern Oudh Circle

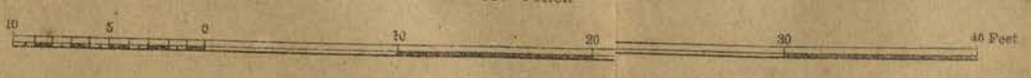
East Elevation



Plan



Scale 8 Feet = 1 Inch



Drawn in the Forest Survey Office by Mr. T.S.Marten from original drawings by Captain E.S. Wood Conservator of Forests Oudh Circle . July 1881.

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún, August 1881.

C. F. Guthrie, Photo. *C. G. Ollenbach, Zinco.*

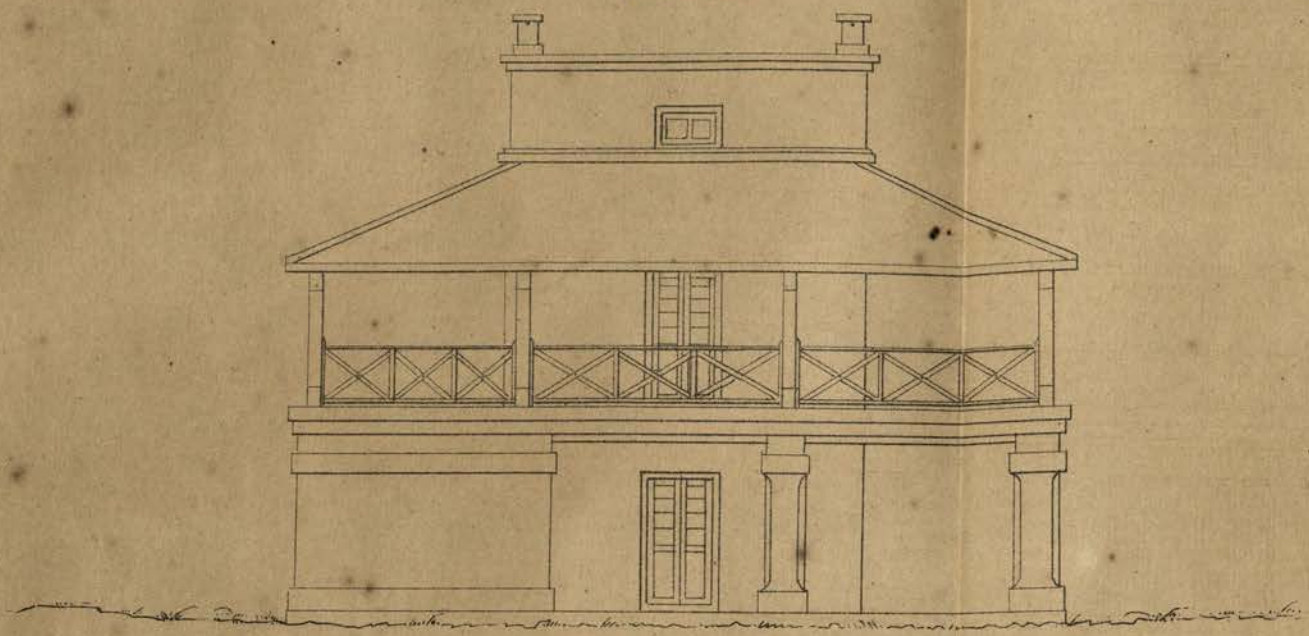
PLAN AND ELEVATION

OF A

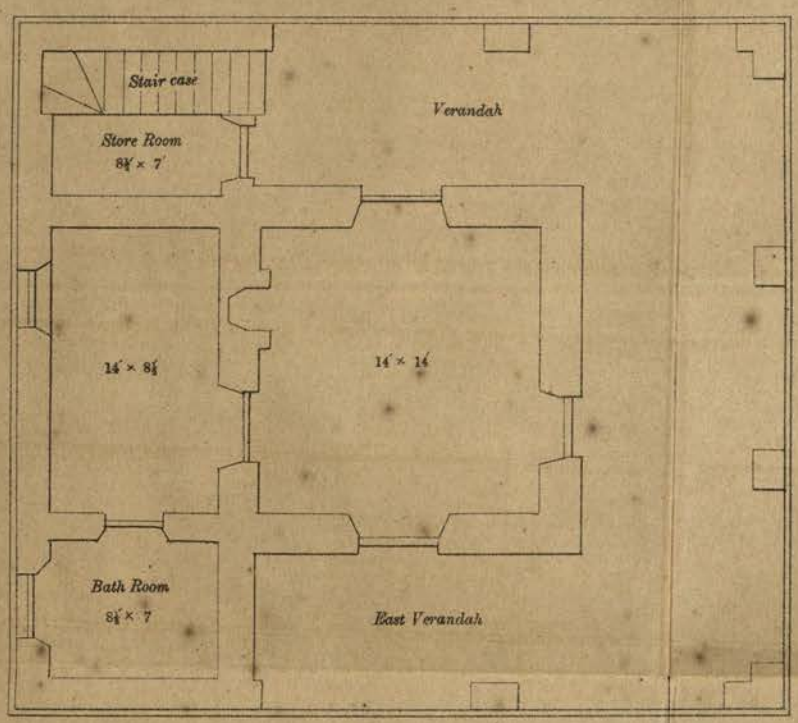
2ND. CLASS DOUBLE-STORIED REST HOUSE

Standard Pattern Oudh Circle

East Elevation



Plan



Scale 8 Feet = 1 Inch.

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PLAN ELEVATION AND SECTION

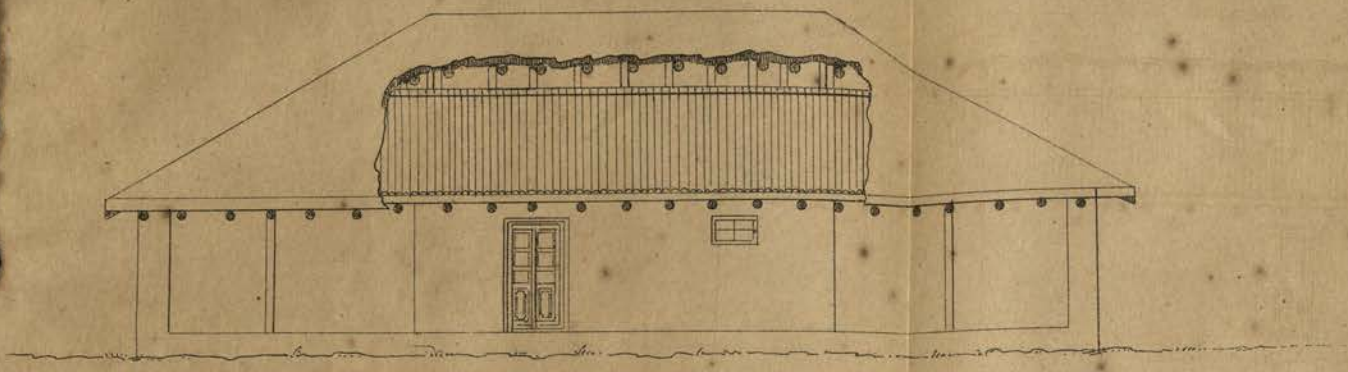
OF A

3RD. CLASS REST HOUSE

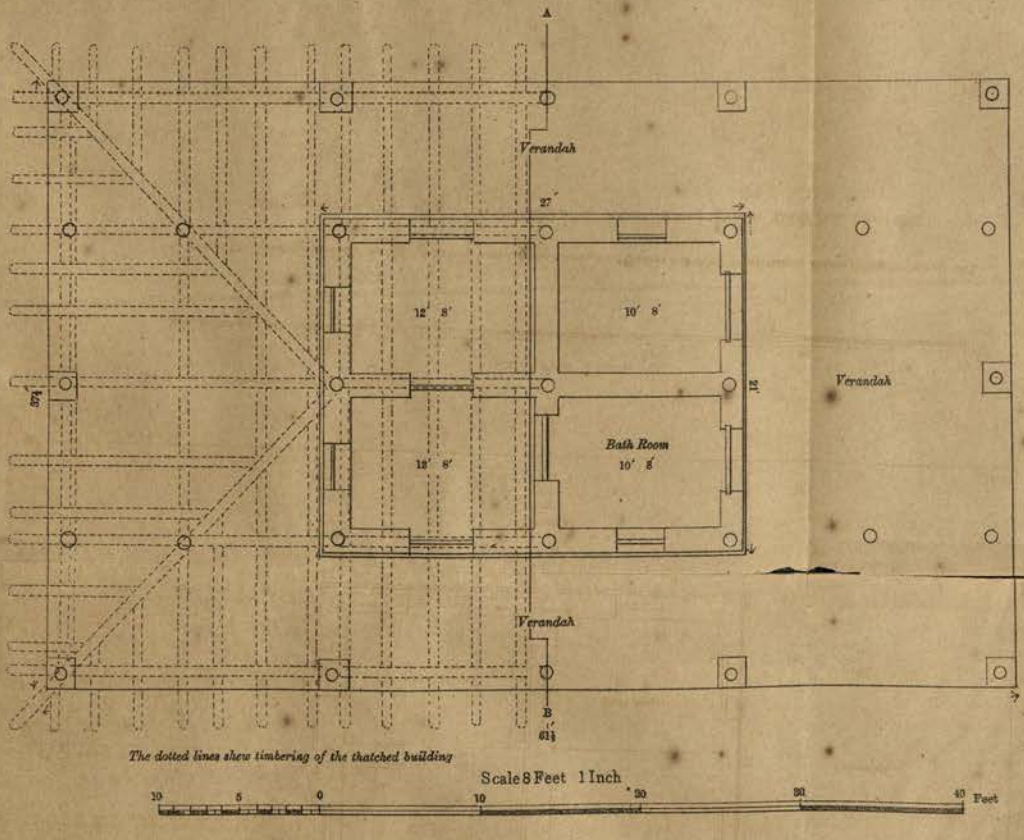
Standard Pattern Oudh Circle

East Elevation

With part of thatch removed to shew inner building



Plan

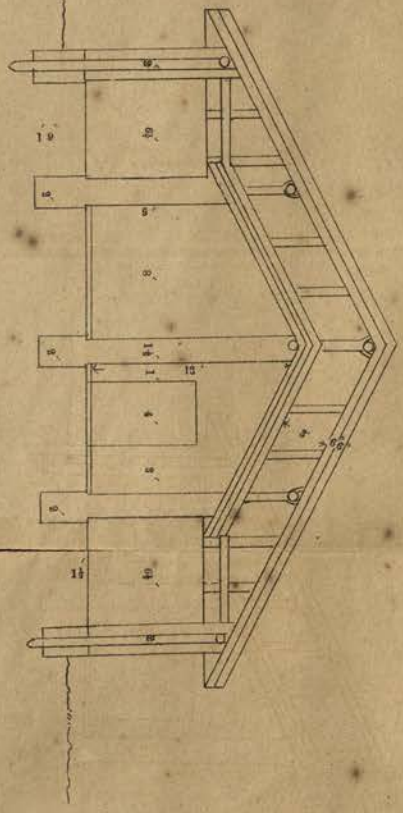


The dotted lines shew timbering of the thatched building

Scale 8 Feet 1 Inch

10 5 0 10 20 30 40 Feet

Sectional Elevation on A B



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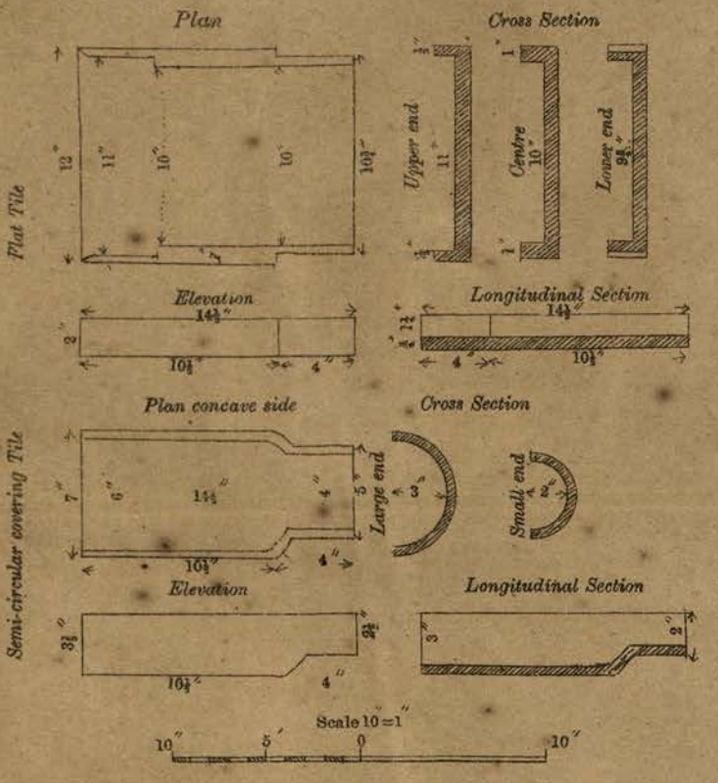
C. F. Guthrie, Photo.

C. G. Ollenbach, Engr.

Detail of Verandah Tiles.



Drawn by Mr. T S. Marten Forest Department from original drawings by Captain Wood Conservator of Forests Oudh Circle

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C. F. Guthrie, Photo. *C. G. Ollenbach, Zinco.*

SUGGESTIONS

REGARDING THE

DEMARCATION AND MANAGEMENT

OF THE

FORESTS IN KULU.

BY

W. SCHLICH, PH. D.,
OFFICIATING INSPECTOR GENERAL OF FORESTS TO THE GOVERNMENT OF INDIA.

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